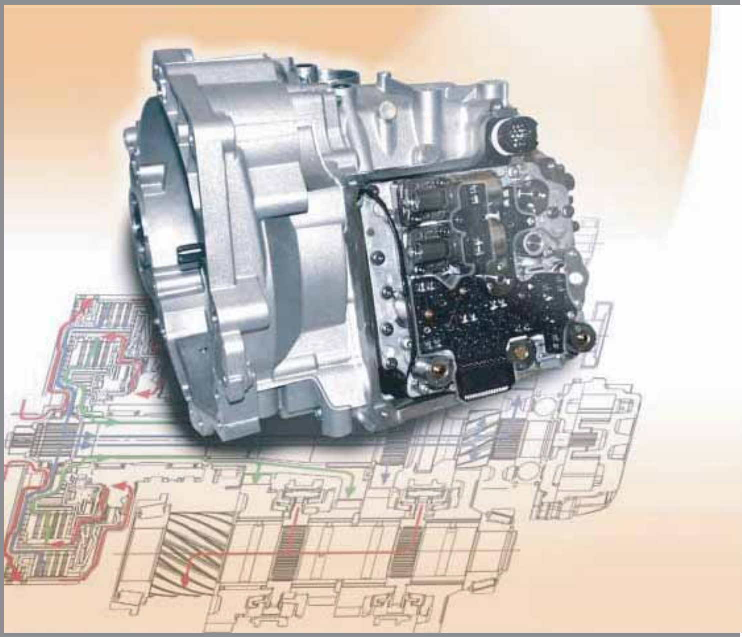
The 02E Direct Shift Gearbox Design and Function



Self-Study Program
Course Number 851403

Volkswagen of America, Inc.
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Course Goals

Course Goals

This course will enable you to:

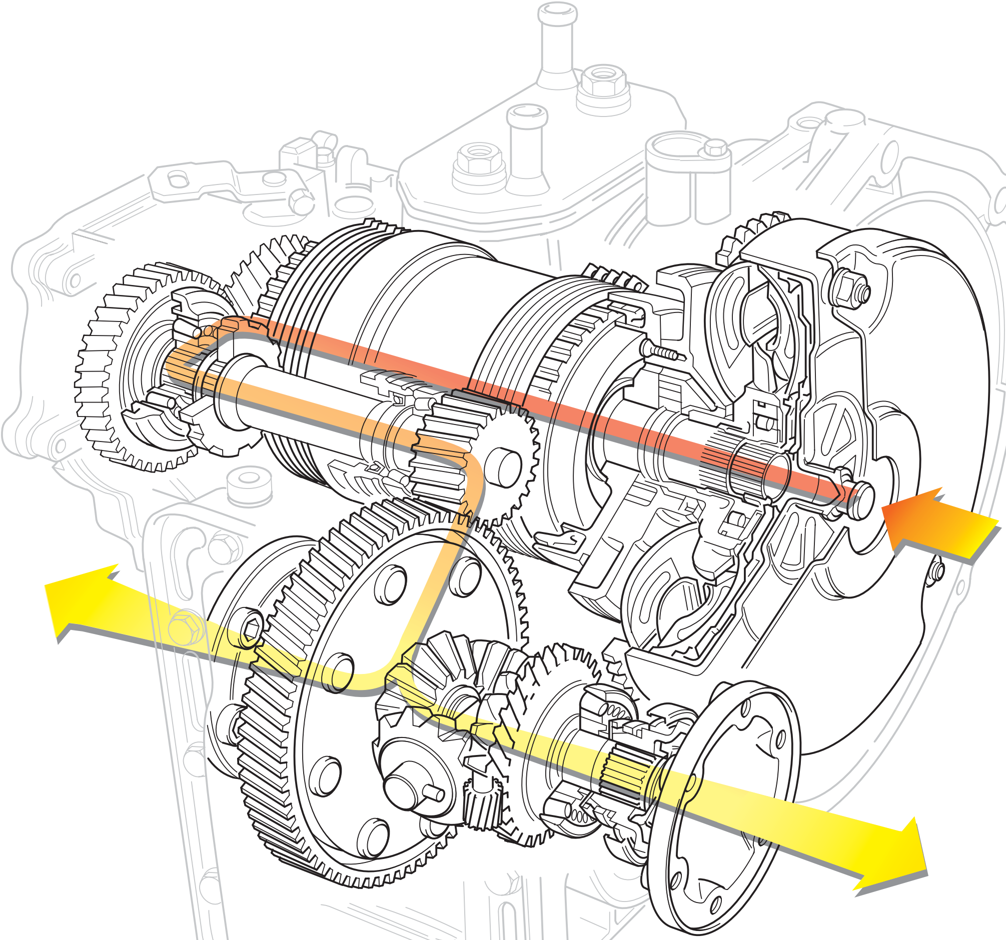
- Discuss the history of the four-speed automatic transmission
- Locate the four-speed automatic transmission components
- Discuss the purpose of the four-speed automatic transmission components

Introduction

The four-speed automatic transmission has received many upgrades since it was first introduced in 1990. Changes have been made to the way range shifts are controlled, the method used to mechanically bypass the torque converter, to the internal gear ratios, and to many other systems, all the while maintaining the basic external appearance of the original.

These changes resulted in different versions (phases) of the transmission; the first of which is referred to as ‘Phase 0’ (zero).

The four-speed automatic transmission utilizes just one planetary gearset. Combined with three clutches (K1, K2, and K3), two brakes (B1 and B2), and one freewheeling clutch (F), this Ravigneaux gearset produces four forward and one reverse range, plus Manual Low.



Overview

Evolution

The main differences from one version to the next are the shift patterns and how the transmission applies the converter clutch.

Currently, there are four main versions of the four-speed automatic transmission:

Phase 0

This is the first phase of the four-speed automatic transmission. Phase 0 includes these units:

- 096 – Golf, Jetta, Passat, and Corrado
- 098 – Eurovan

The main characteristics of the Phase 0 unit are:

- It uses an ECO/SPORT switch to control the transmission shift pattern
- The K3 clutch pack controls the torque converter lockup
- The basic shift pattern* is 1H, 2H, 3H, 3M, 4M. It provides an additional range, 3LT2, during downshift
- There is no speed sensor for the sun shell
- The transmission is equipped with a fluid level dipstick

Phase 1

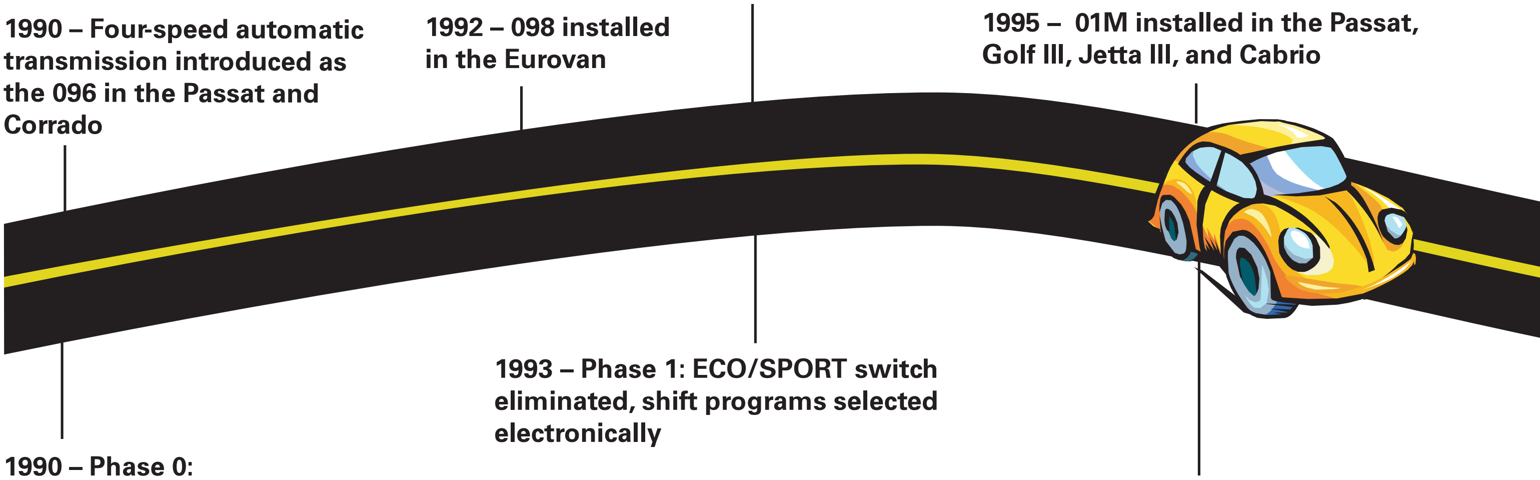
This is the second version of the four-speed automatic transmission. Phase 1 includes these units:

- 096 – Golf, Jetta, Passat, and Corrado
- 098 – Eurovan

The main characteristics of the Phase 1 unit are:

- The ECO/SPORT switch is no longer in use
  - – The transmission computer develops this signal internally, based on vehicle operating conditions
- The K3 clutch pack still controls converter lockup
- The basic shift pattern* is 1H, 2H, 3H, 4M
- There is no speed sensor for the sun shell
- The transmission is equipped with a fluid level dipstick

The only way to tell the difference between the Phase 0 and Phase 1 externally is by looking at the connector on the multi-function switch.



1990 – Four-speed automatic transmission introduced as the 096 in the Passat and Corrado

1990 – Phase 0: ECO/SPORT switch

1992 – 098 installed in the Eurovan

1993 – 096 installed in the Golf III and Jetta III

1993 – Phase 1: ECO/SPORT switch eliminated, shift programs selected electronically

1995 – 01M installed in the Passat, Golf III, Jetta III, and Cabrio

1995 – Phase 2: ECO/SPORT programs replaced with "Fuzzy Logic", lockup clutch moved to torque converter, dipstick eliminated, new, "yellowish" color, synthetic ATF

Phase 2

This is the third version of the four-speed automatic transmission. Phase 2 includes these units:

- 01M – Golf, Jetta, and New Beetle
- 01P – Eurovan

The main characteristics of the Phase 2 unit are:

- The converter now has a built-in clutch for lockup; the K3 clutch is used for third and fourth gear operation
- The basic shift pattern* is 1H, 1M, 2H, 2M, 3H, 3M, 4H, 4M
- A speed sensor was added to the top of the transmission case to monitor the sun shell operation
- Phase 2 transmissions no longer include a dipstick for checking the fluid level

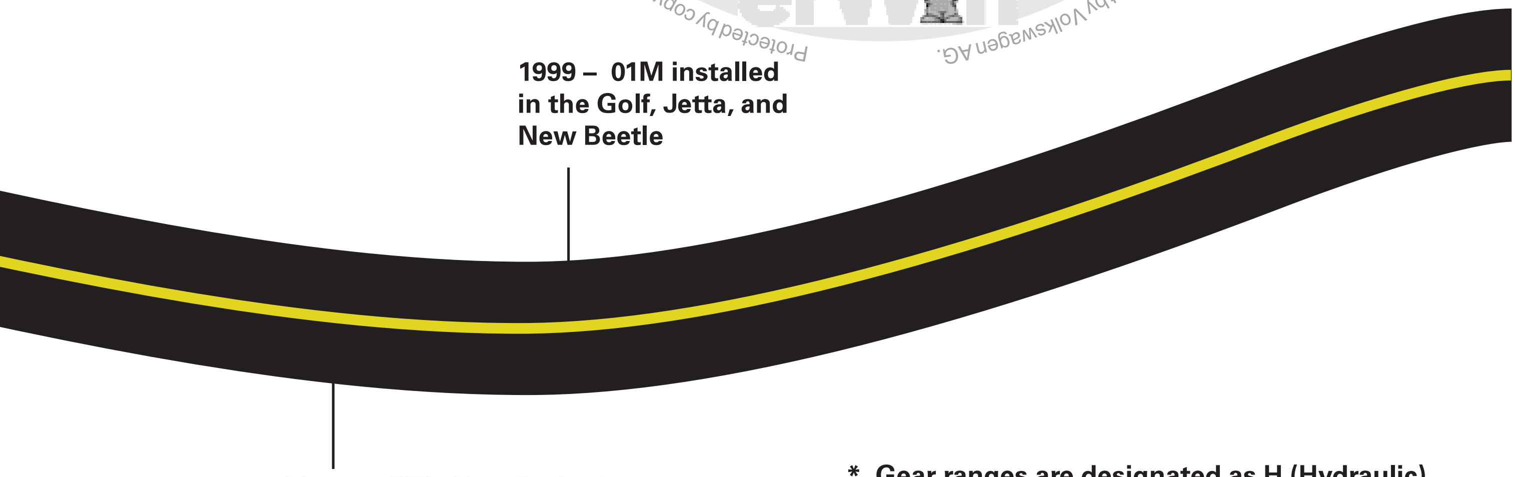
Phase 2 ETA

This is the fourth and current version of the four-speed automatic transmission. Phase 2 ETA includes these units:

- 01M – Golf, Jetta, and New Beetle
- 01P – Eurovan

The main characteristics of the Phase 2 ETA unit are:

- The B2 brake is new, utilizing “wavy” clutch disks to provide less drag when the brake is disengaged
- A new fixture is used to set the clearances on the B2 brake
  - – This fixture is now used to set the B2 brake on all previous phases
- The basic shift pattern remains unchanged
- The operation of valves in the valve body is modified



1999 – 01M installed in the Golf, Jetta, and New Beetle

1998 – Phase 2 ETA: New B2 brake with “wavy” clutch disks

*** Gear ranges are designated as H (Hydraulic) or M (Mechanical), referring to the state of the torque converter.**

Overview

Transmission Identification

Depending on the year and model of the vehicle, the transmission could have one of a few different designations, including 096, 01M, 01P, etc. While not identical, all of these units are part of the four-speed automatic transmission family.

By phase, we mean that this transmission has undergone several modifications since it first appeared in Volkswagen vehicles.

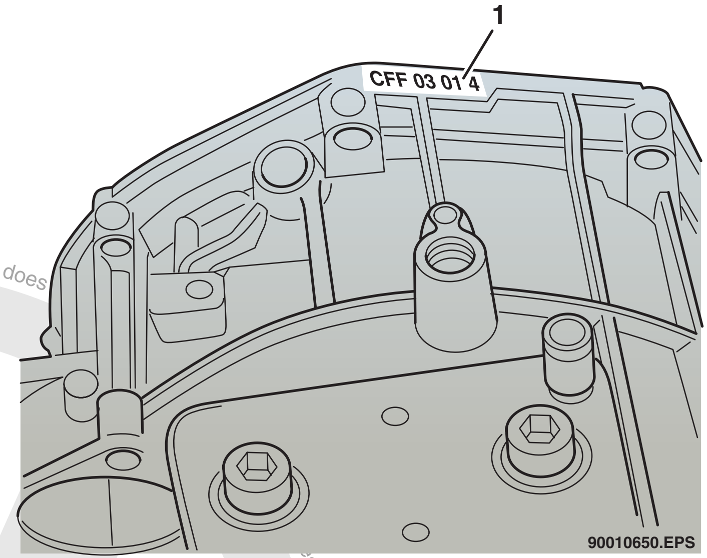
While each phase is similar, there are specific differences. More importantly, these different phase transmissions are not interchangeable; you must use parts and components for the transmission phase that came with the vehicle. Crossing components from one phase to another will cause problems – some of which **will damage** the transmission.

Identify the transmission from its serial number to ensure you are using the right components for the vehicle you are working on. The serial numbers and data tags are in different locations, based on the phase.

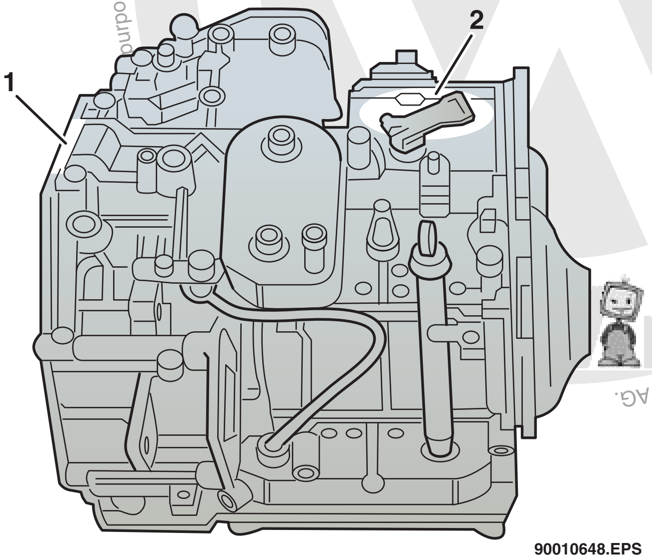
Phase 0 and 1 transmissions are identified by the date of manufacture (location 1) and type (096, location 2).

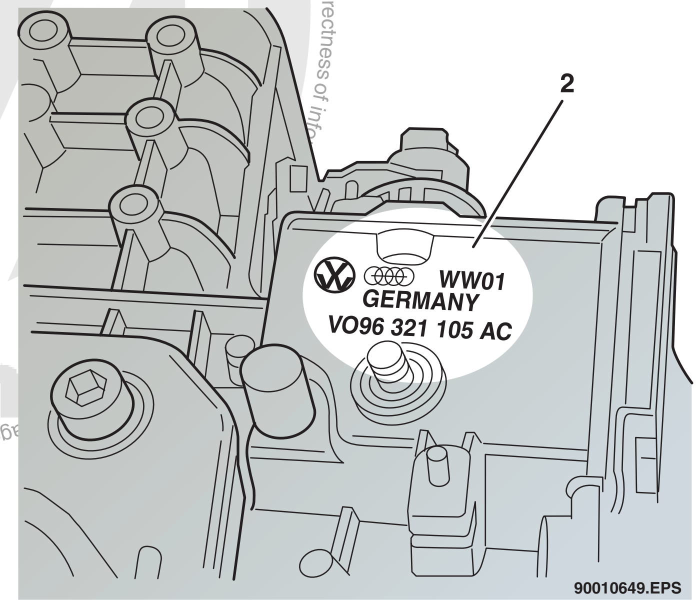
For example, CFF 03 01 4:

CFF	Transmission code letters
03	Day (3rd)
01	Month (January)
4	Year (1994)



Phase 0 and Phase 1 Tag Locations





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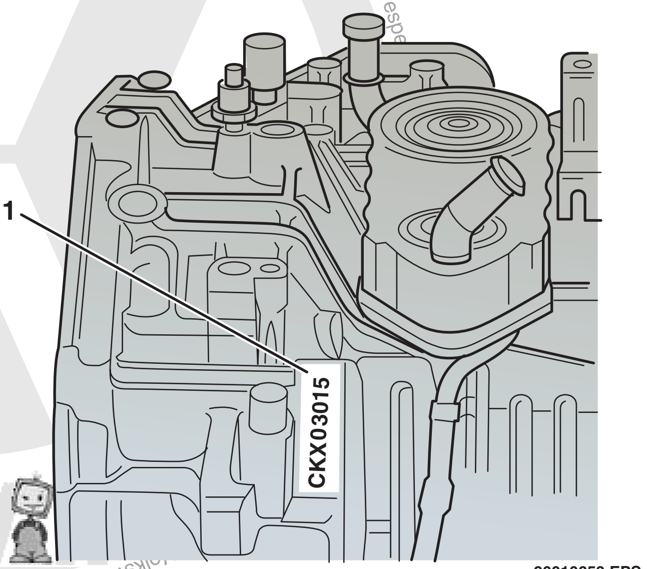
Phase 2 and Phase 2 ETA codes are deciphered in the same way as the Phase 0 and 1 codes.

For example, CKX03015:

CKX	Transmission code letters
03	Day (3rd)
01	Month (January)
5	Year (1995)

The type, 01M, is shown in location 2.



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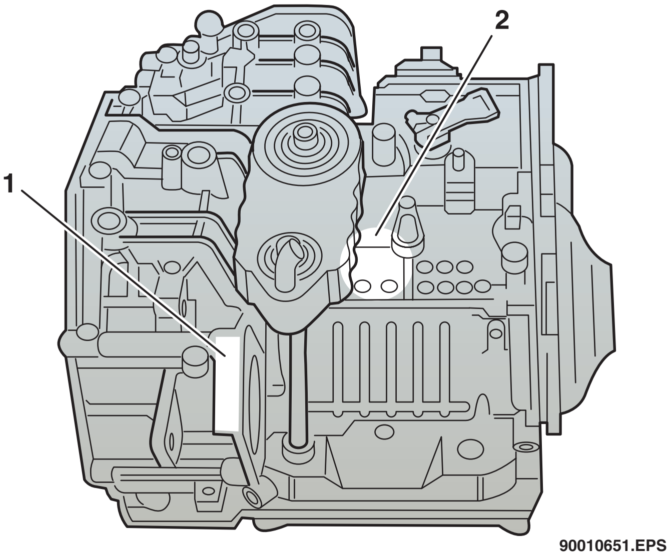
Phase 2 and Phase 2 ETA Tag Locations



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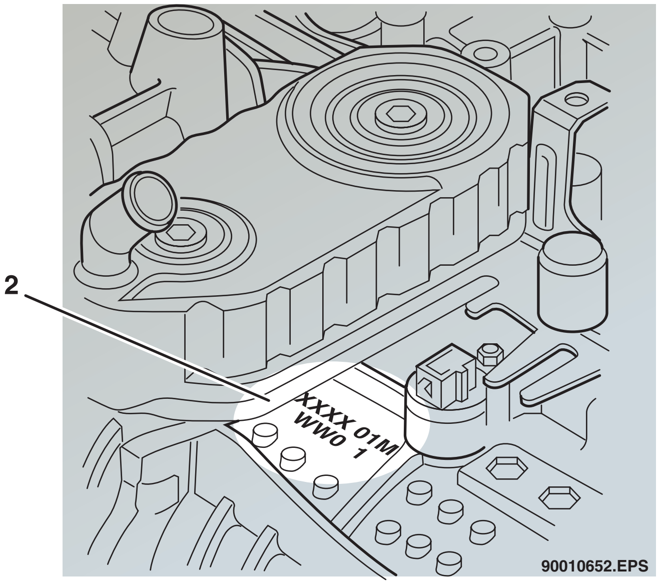

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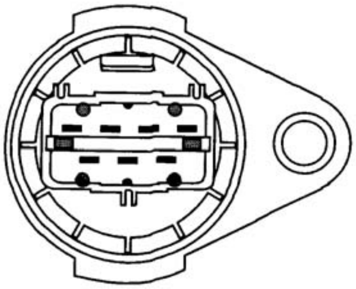
Overview



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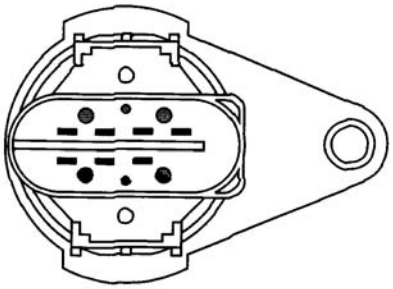
Phase 0 Multi-function Switch



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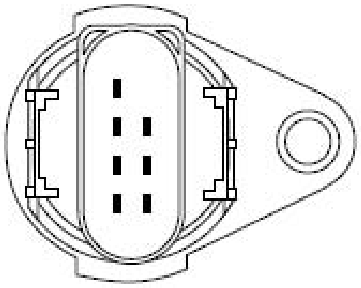
Phase 1 and 2 Multi-function Switch



90010428.EPS

Hall Effect Style Multi-function Switch

Shortly after the introduction of the Phase 2 transmission, the Hall Effect-style multi-function switch was introduced. This switch is a direct replacement for the Phase 1 and Phase 2 design switch. The signals on the VAS 5051 will be the same with this switch as they were with the older design, but the test procedure for the switch will be different. Refer to current service information for the test procedures for this multi-function switch.

Determining the transmission version is critical to obtaining the correct parts and specifications. Always identify the transmission from its serial number.

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Hydraulic Torque Converter

The torque converter transfers power from the engine to the transmission. This is done hydraulically, allowing the vehicle to come to a full stop without shifting into neutral or releasing a clutch.

The basic torque converter consists of the:

- Impeller or pump
- Turbine
- Stator

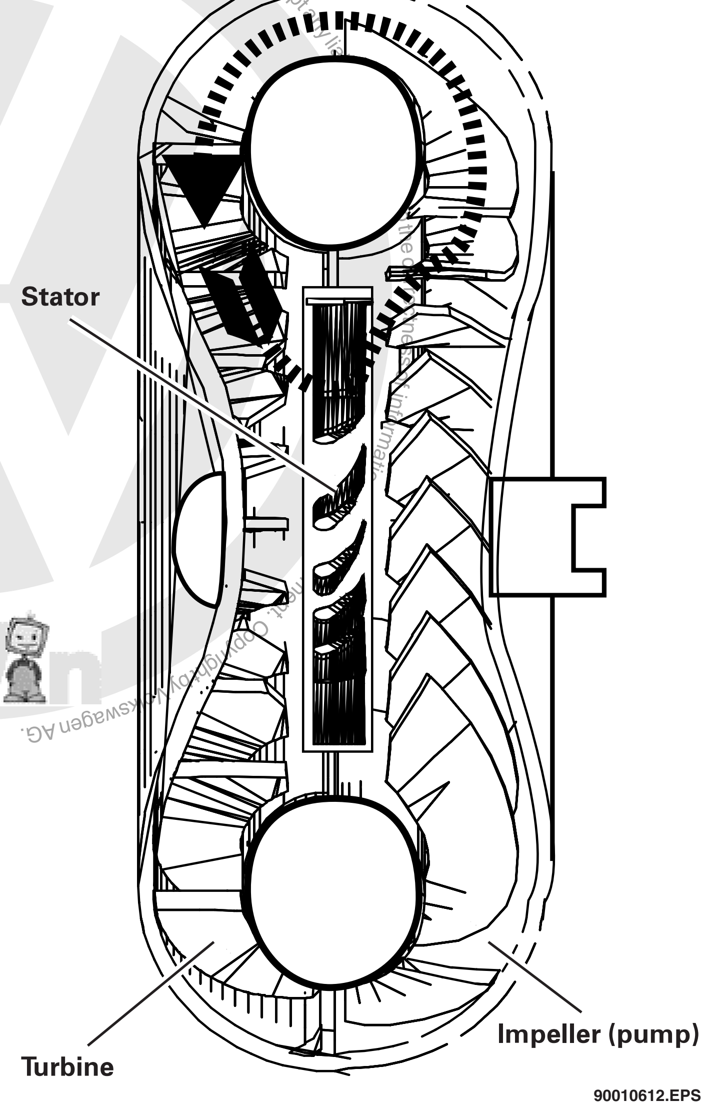
The impeller mounts to the converter housing, which bolts to the flywheel. The turbine is splined to the transmission input shaft.

When the engine is running, the impeller slings the oil in the converter into the fins on the turbine. The pressure of the oil being thrown against the turbine transfers the torque to the transmission input shaft. From there, the torque is passed through the gearset to drive the vehicle.

However, once the oil leaves the turbine, it is moving in the opposite direction of the impeller blades. The stator changes this condition. It is mounted between the turbine and the impeller and redirects the oil so it is moving in the same direction as the impeller. By changing the direction of the oil as it leaves the turbine, the stator actually increases the overall torque in the system. This process is called torque multiplication.

When the engine is applying power to the torque converter assembly, the stator is locked against its one-way clutch. The stator will unlock and begin to rotate slowly when the impeller and turbine have reached similar speeds.

The torque converter has the ability to multiply the torque of the engine up to 2 1/2 times.

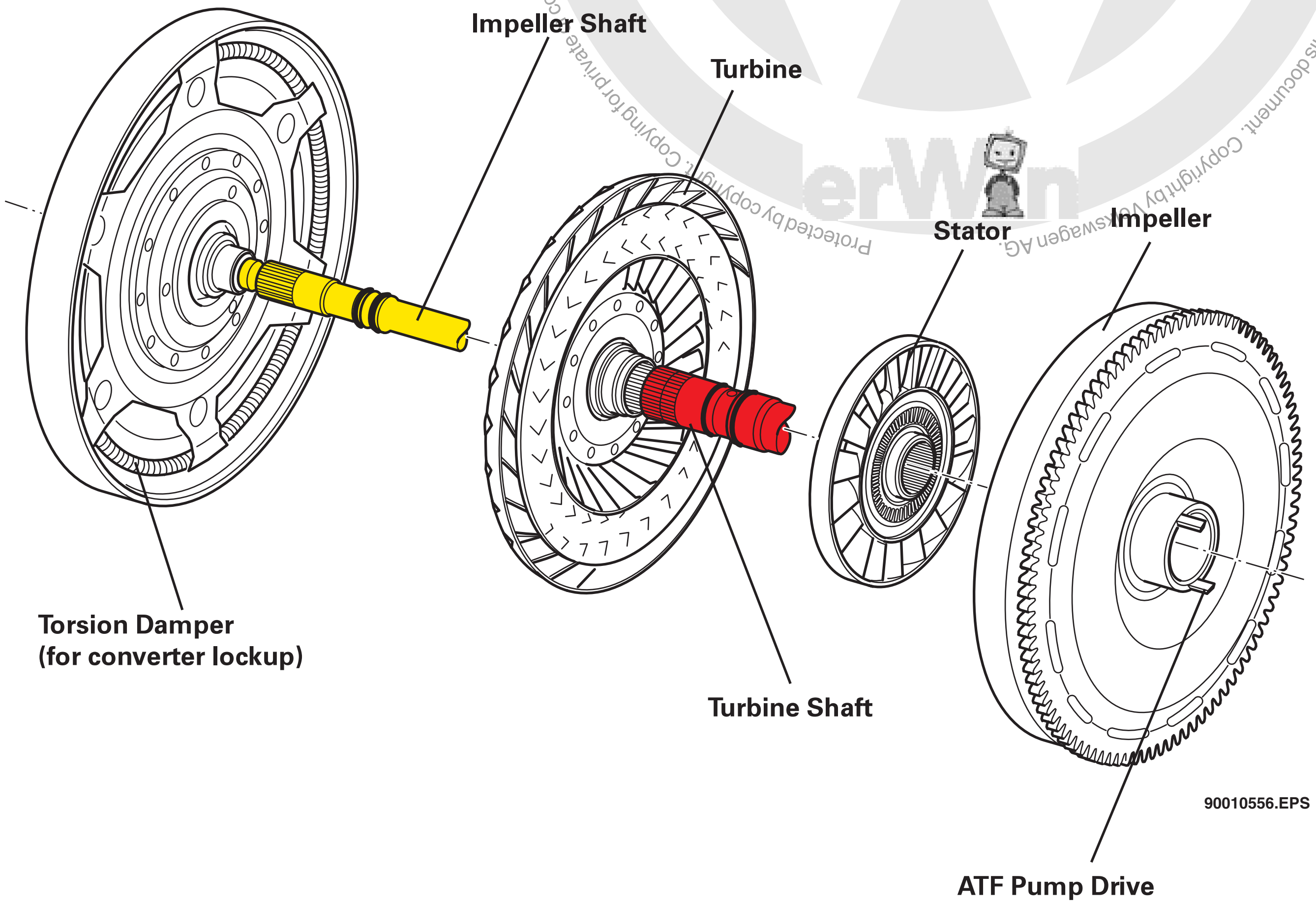


Torque Converter Lockup

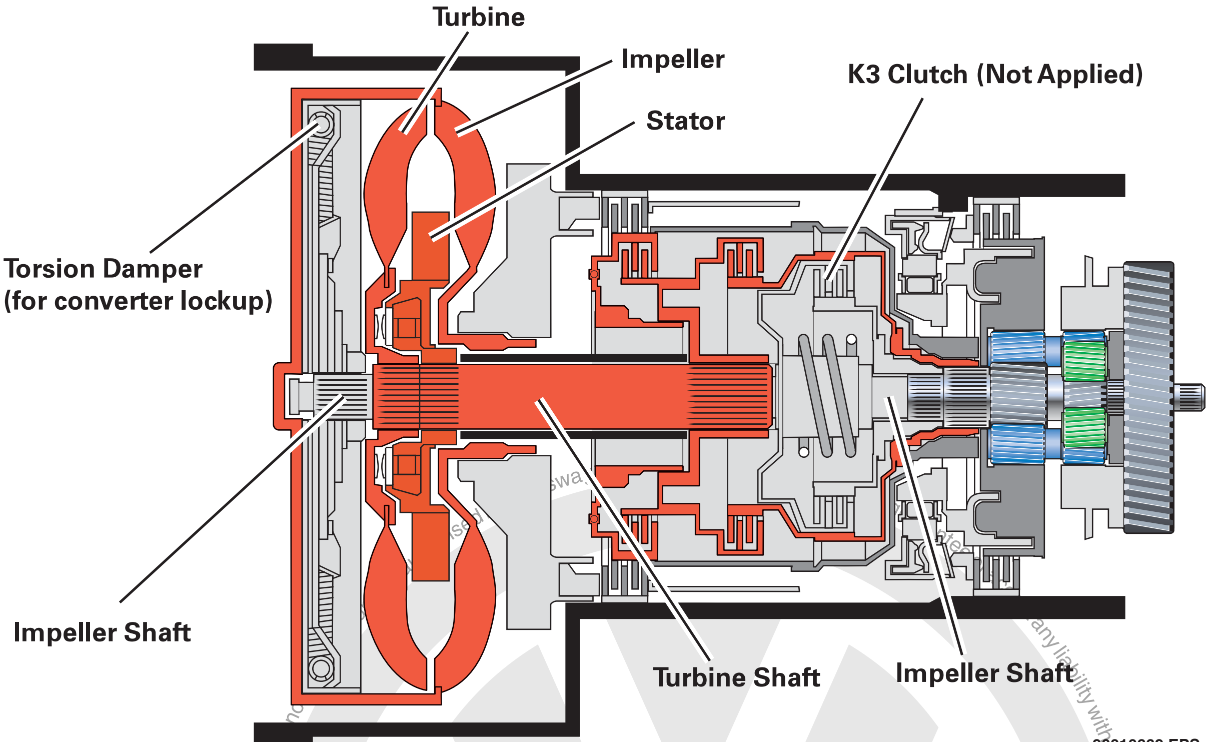
Due to the slippage between the turbine and impeller, a torque converter can only transfer about 85 percent of engine power through to the transmission at cruising speeds. To increase fuel economy, reduce emissions, and reduce heat buildup, a means of mechanically connecting the transmission to the engine was needed.

In the Phase 0 and Phase 1 units, this was accomplished by connecting a shaft to a damper welded to the torque converter housing. The other end of this impeller shaft is connected to the K3 clutch.

When the clutch is applied, power is transmitted directly to the planetary gearset, 'bridging' the torque converter.

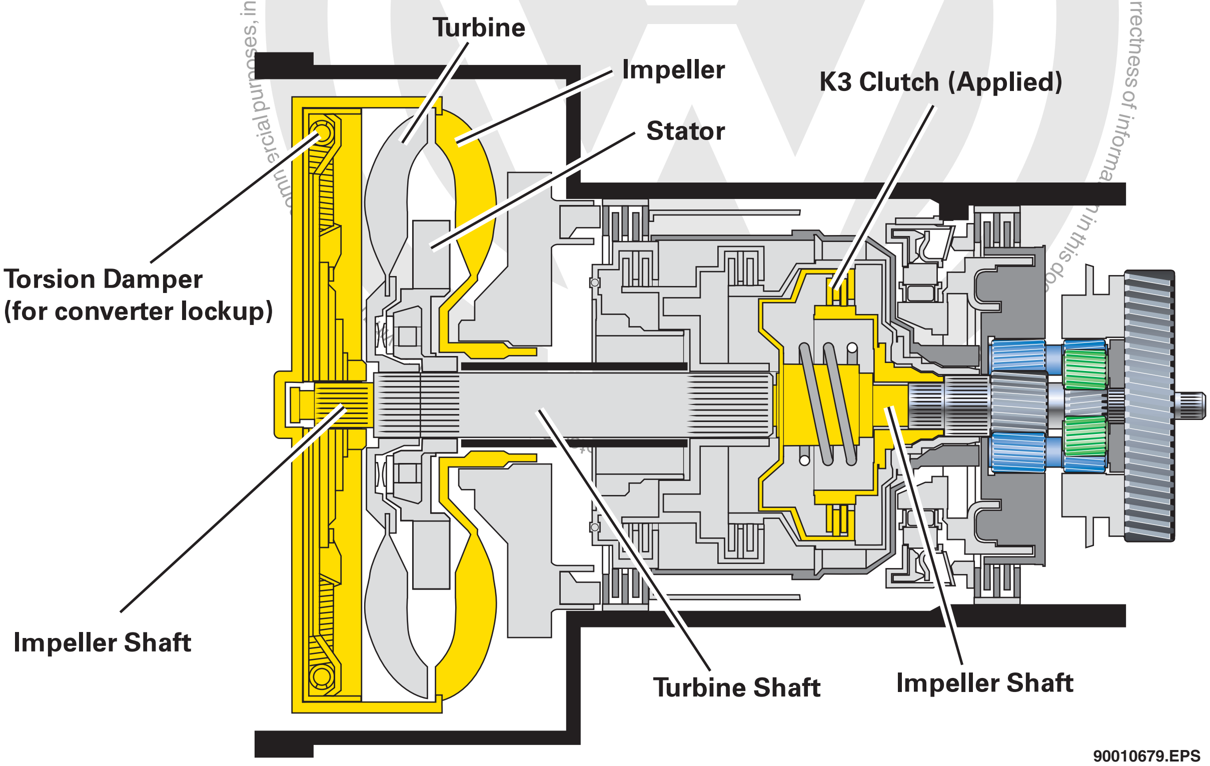

Impeller Shaft
Turbine
Stator
Impeller
Torsion Damper
(for converter lockup)
Turbine Shaft
90010556.EPS
ATF Pump Drive

Phase 0 and Phase 1 Hydraulic Operation (K3 Clutch Not Applied)


Turbine
Impeller
K3 Clutch (Not Applied)
Stator
Torsion Damper (for converter lockup)
Impeller Shaft
Turbine Shaft
Impeller Shaft

90010669.EPS

Phase 0 and Phase 1 Mechanical Operation (K3 Clutch Applied)


Turbine
Impeller
K3 Clutch (Applied)
Stator
Torsion Damper (for converter lockup)
Impeller Shaft
Turbine Shaft
Impeller Shaft

90010679.EPS

Torque Converter Clutch (TCC)

Beginning with the Phase 2 units, the lockup clutch was moved inside the torque converter and renamed the Torque Converter Clutch (TCC). The TCC performs the same function as the combination of the K3 clutch and impeller shaft, but with fewer parts and less weight.

The TCC locks the transmission input shaft directly to the housing of the torque converter, eliminating the fluid coupling and driving the transmission directly from the crankshaft. This eliminates all slip from the torque converter. Since the torque converter produces most of the heat in the transmission, the application of the TCC greatly reduces heat production in the converter.

The TCC in the Phase 2 and Phase 2 ETA has three stages of operation: not applied, control, and applied. These stages can be viewed through the VAS 5051 under the Read Data Block function.

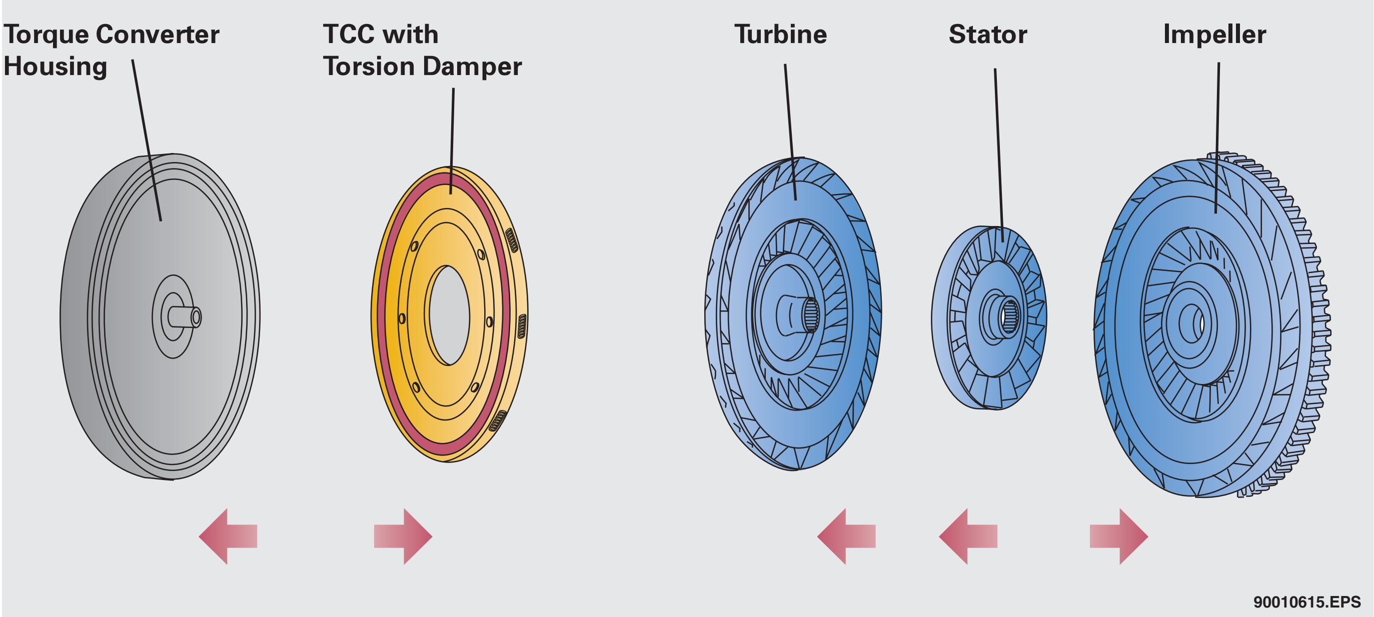
The TCC is inactive during the not applied stage. This is normally in the lower gears under high load.

The TCC is applying, but not fully, during the control stage. This usually happens in the lower gears and under heavy throttle.

The TCC is fully applied during the applied stage. This condition occurs in the higher gears and at light throttle. This also may happen in the lower gears in mountainous regions to increase the engine braking effect on the vehicle.

The torsion damper at the TCC reduces the transfer of the engine's torsional vibrations through the transmission.

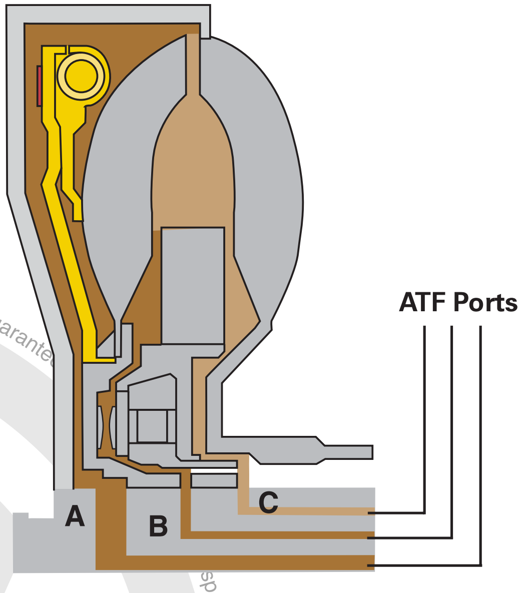
Components of the TCC



Operating Principle of the TCC

There are three ports in the turbine shaft that carry oil to and from the torque converter. Port B supplies oil to the planetary gearset, while ports A and C are pressurized alternately to open and close the TCC.

The TCC is operated by a modulation valve in the valve body. If the Transmission Control Module (TCM) decides, based on engine speed and torque, that it would be more economical to apply the TCC, it activates valve N91. Because N91 is a modulation valve, it is possible to specifically increase and/or reduce the pressure when closing and opening the TCC, allowing for smooth, comfortable operation.



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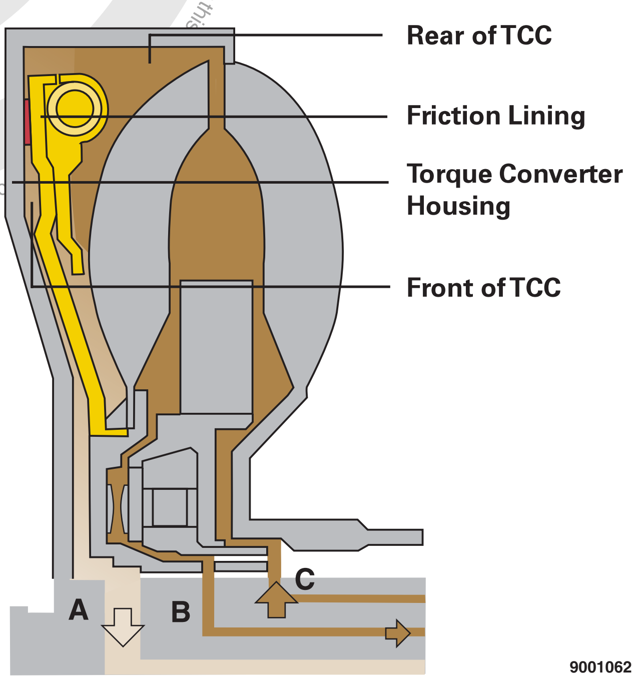
The TCC is Not Applied

The TCC is held open by a diaphragm-type spring. The Automatic Transmission Fluid (ATF) flows through ports A and B. Port C is closed. Pressure on both sides of the TCC is equal, thus pressure from the diaphragm spring holds the TCC open.

The TCC is Applied

ATF is fed through port C while port A is opened. As a result, the oil pressure on the rear of the TCC is higher than on the front, overcoming the spring pressure. The friction lining moves against the torque converter housing and creates a positive connection from the engine to the transmission.



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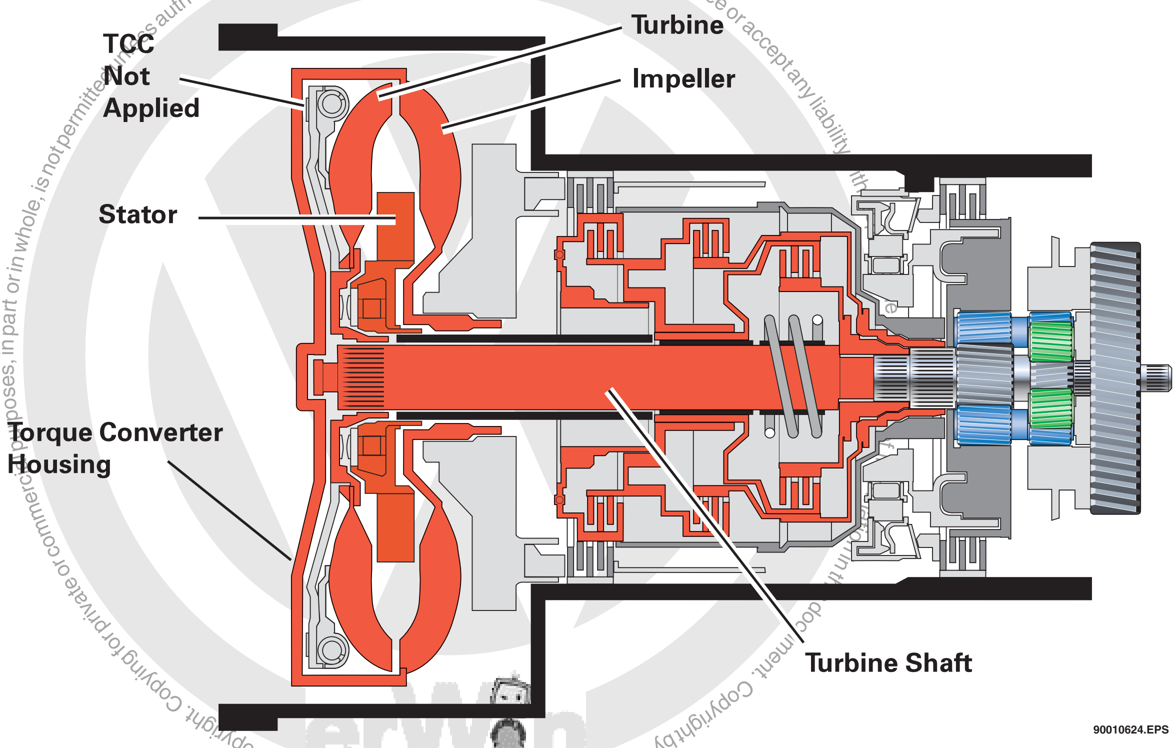
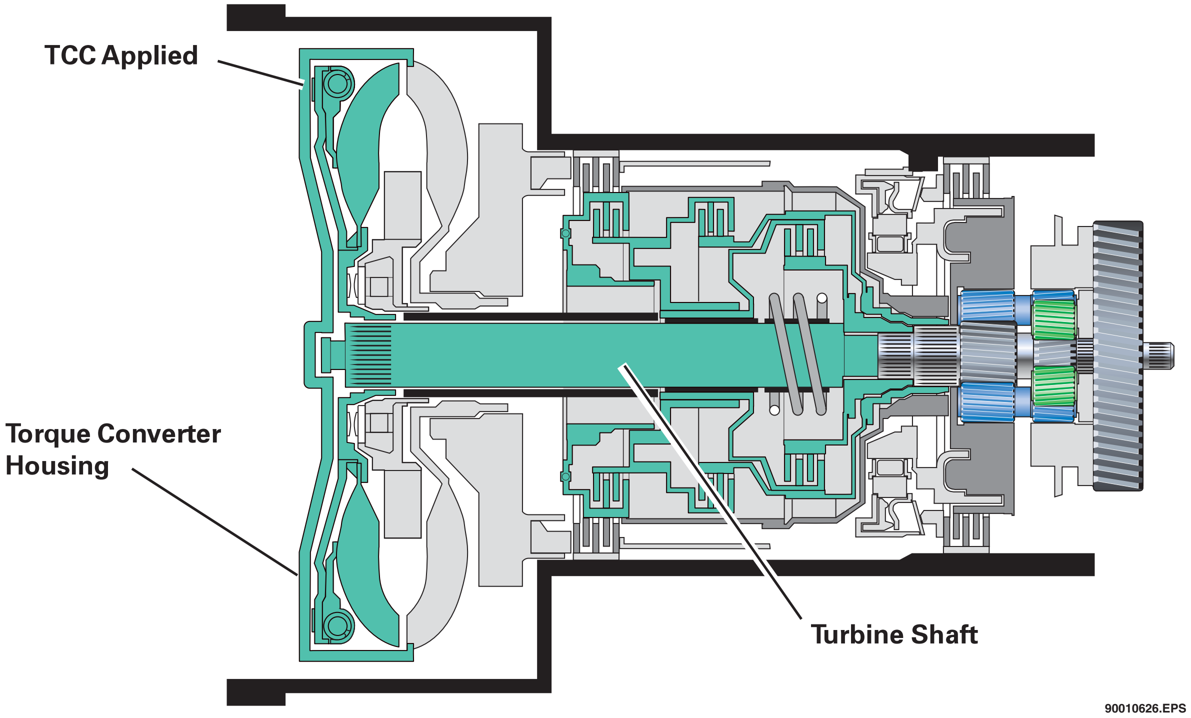
Phase 2 and Phase 2 ETA Hydraulic Power Flow (TCC Not Applied)


TCC Not Applied
Turbine
Impeller
Stator
Torque Converter Housing
Turbine Shaft
90010624.EPS

Phase 2 and Phase 2 ETA Mechanical Power Flow (TCC Applied)


TCC Applied
Torque Converter Housing
Turbine Shaft
90010626.EPS

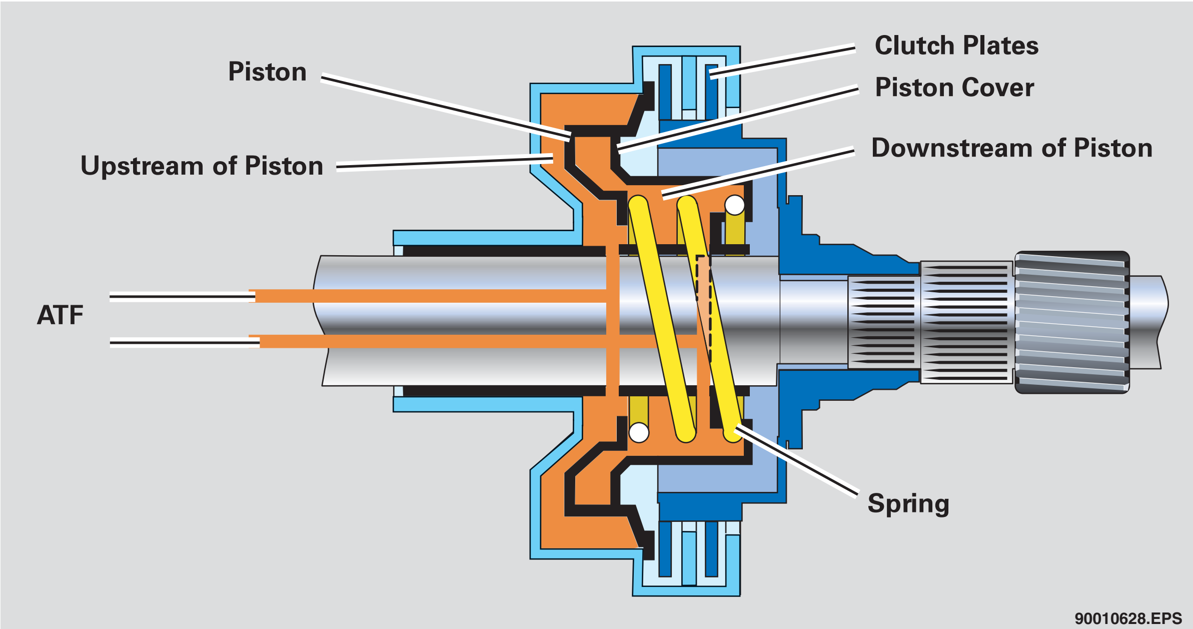
Clutches and Brakes

Volkswagen uses three different methods to hold or turn the different geartrain components:

- Clutches
- Brakes
- Freewheeling Clutches; also known as one-way clutches, or overrunning clutches. Volkswagen uses one-way roller clutches for its freewheeling clutches

The multi-plate clutches and brakes in the four-speed automatic transmission are operated by the ATF forcing a piston against spring pressure to apply the clutch. Clutches and brakes operate in the same manner; the only difference is their function. Clutches couple two components together, while brakes prevent rotation by holding components to the transmission case.

Effective with Phase 1, the multi-plate clutches K1 and K3 are balanced in respect to the centrifugal force. This enables the gearshifts to be performed smoothly and softly with a uniform quality.



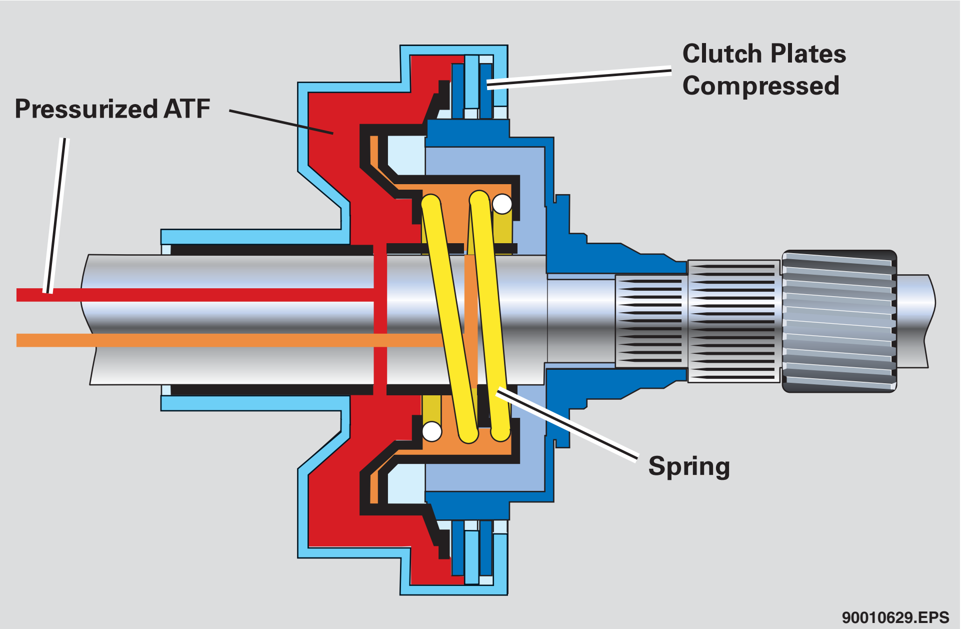
The Clutch is Not Applied

The spring holds the clutch open, regardless of engine speed. The ATF upstream and downstream of the piston does not have pressure. The redesigned piston cover in the Phase 1 and later transmissions prevents centrifugal force from compressing ATF into the clutch disks, creating drag. Preventing this pressure results in uniformly smooth gearshifts.

The Clutch is Applied

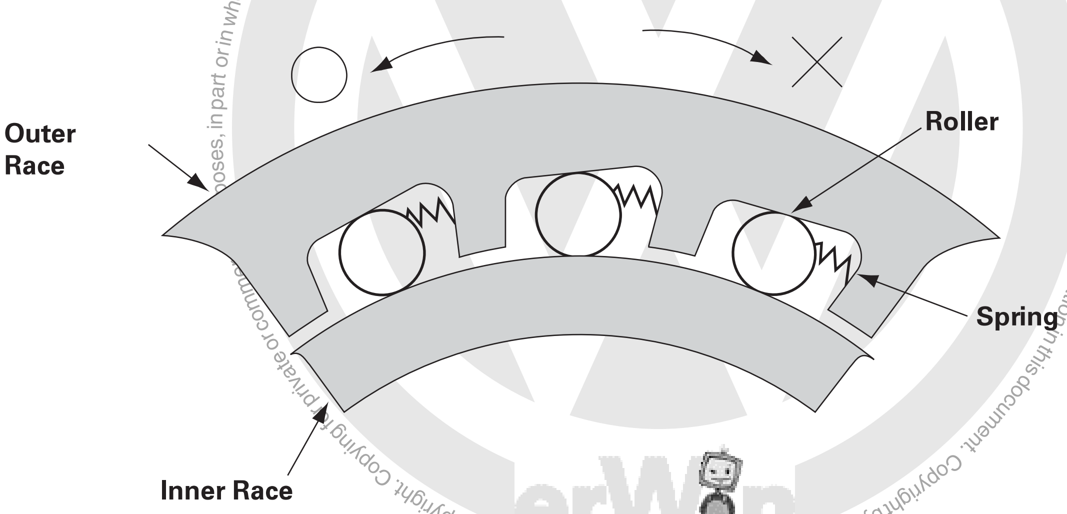
ATF is forced under pressure into the chamber upstream of the piston to apply the clutch. The ATF pressure overcomes the spring tension and compresses the clutch plates.

Power is now transmitted through the clutch plates.


Pressurized ATF
Clutch Plates Compressed
Spring
90010629.EPS

Freewheeling Clutch

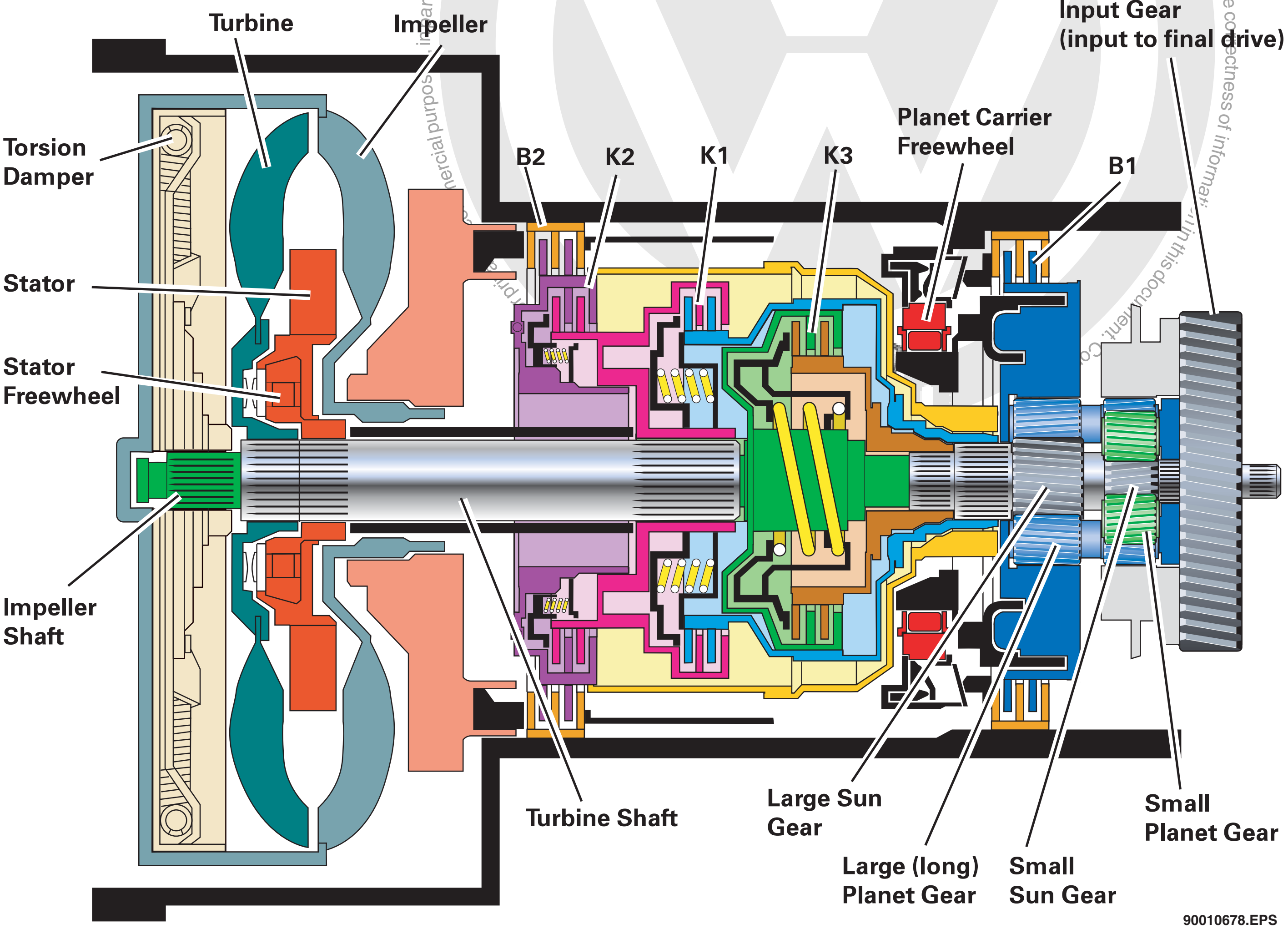
The third type of clutch used in the four-speed automatic transmission is the freewheeling clutch. This type of clutch permits rotation in one direction only, through the use of rollers under spring tension.


Outer Race
Roller
Spring
Inner Race
90010668.EPS

Power Flow

Power flow in the four-speed automatic transmission varies with the different phases. The earlier versions (Phase 0 and Phase 1) use a separate shaft, engaged by the application of clutch K3 (solenoid valve N90), to provide a direct, mechanical connection between the engine and transmission.

Beginning with Phase 2 and continuing with Phase 2 ETA, this mechanical connection is achieved with a TCC inside the torque converter. The TCC is controlled by modulation valve N91.

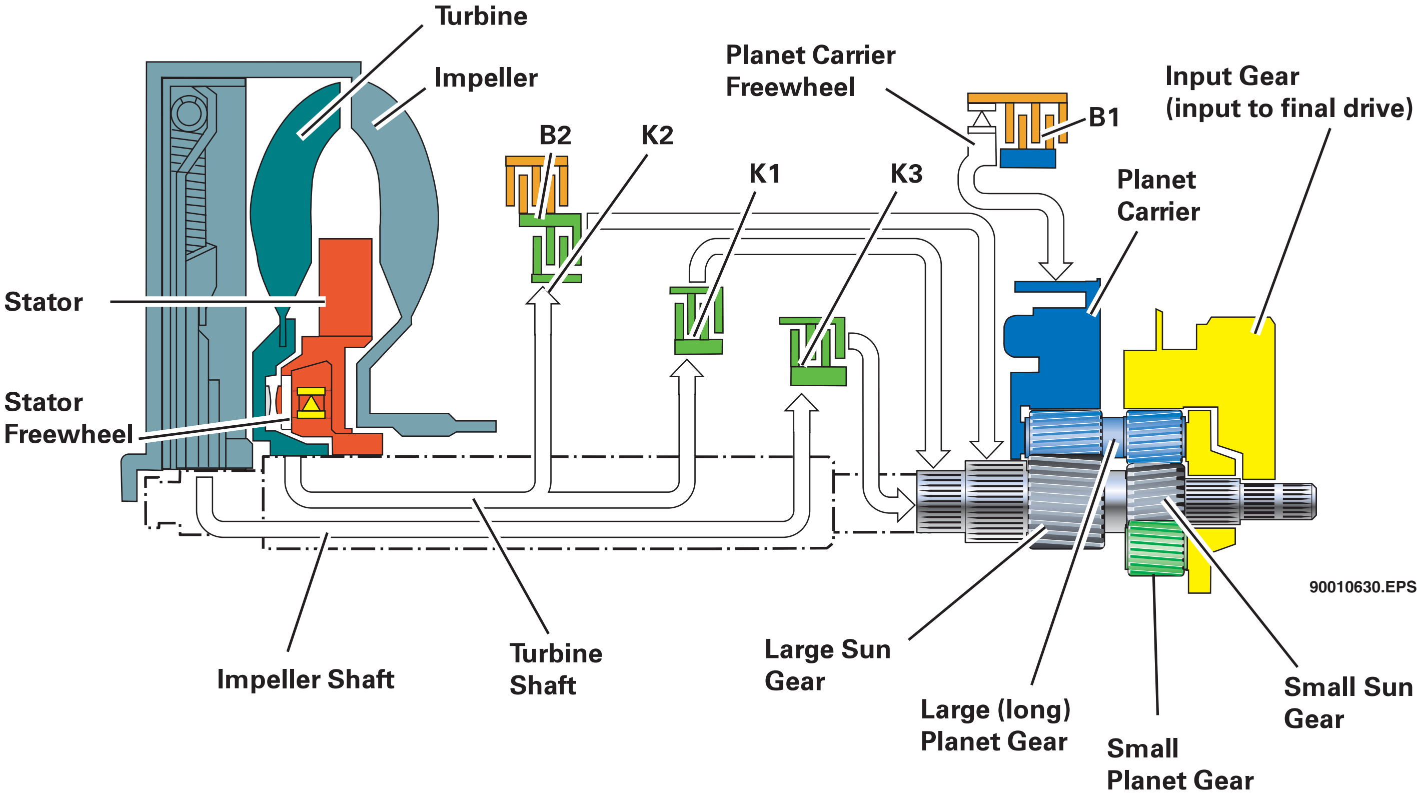

Turbine
Impeller
Input Gear
(input to final drive)
Torsion
Damper
Planet Carrier
Freewheel
B2
K2
K1
K3
B1
Stator
Stator
Freewheel
Impeller
Shaft
Turbine Shaft
Large Sun
Gear
Large (long)
Planet Gear
Small
Sun Gear
Small
Planet Gear
90010678.EPS

Phase 0 and Phase 1

Power flow is illustrated on the following pages using schematics similar to the example below.

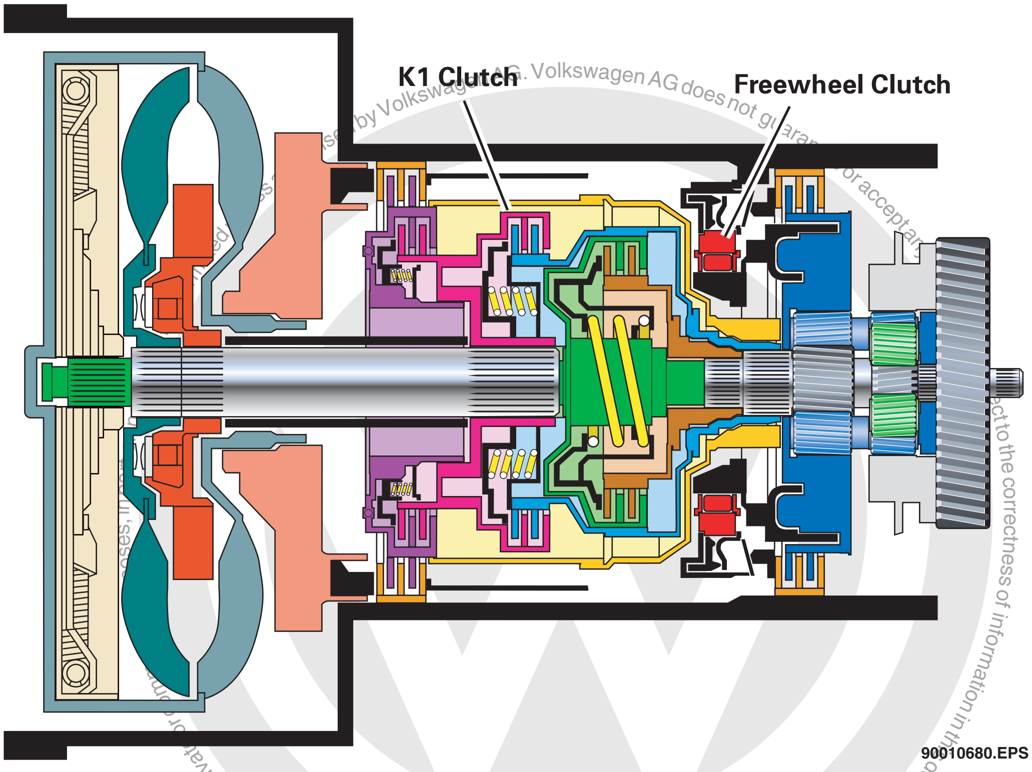
Only the active components are 'called out' in the schematics.

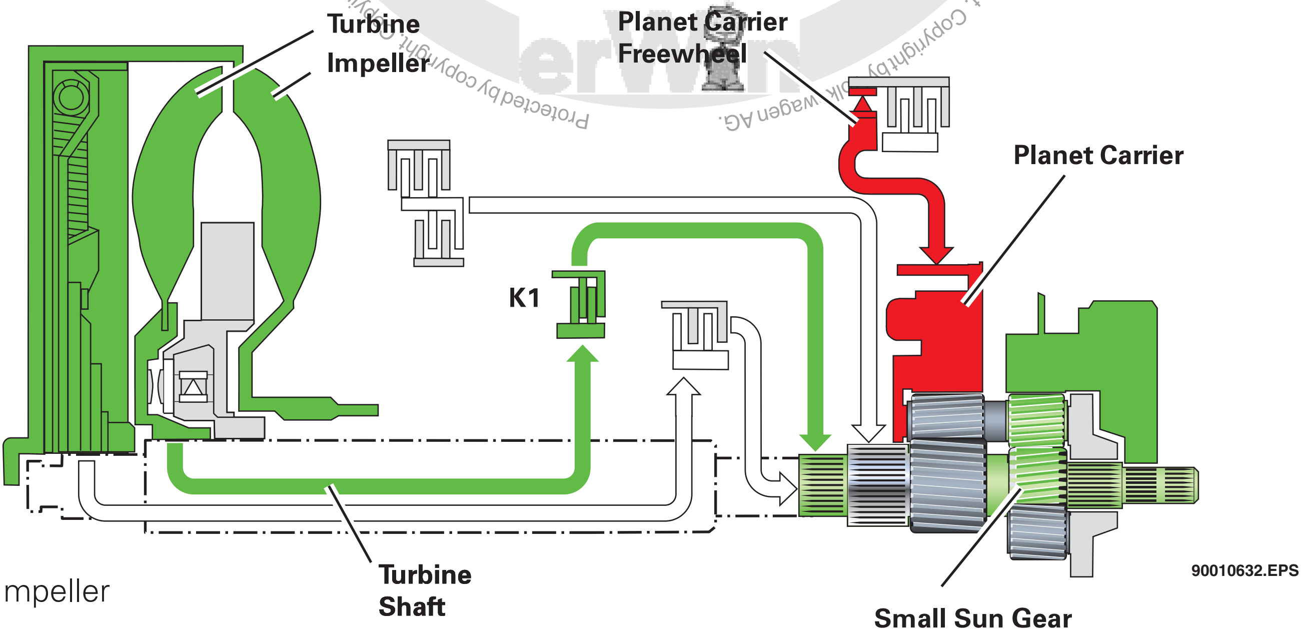
Gear ratios are given as examples only. Actual ratios vary with application. Always refer to current service information for the most accurate specifications.


Turbine
Impeller
Planet Carrier Freewheel
B1
Input Gear (input to final drive)
B2
K2
K1
K3
Planet Carrier
Stator
Stator Freewheel
90010630.EPS
Impeller Shaft
Turbine Shaft
Large Sun Gear
Large (long) Planet Gear
Small Planet Gear
Small Sun Gear

1st Gear Hydraulic, Phase 0 and 1
Selector Position "D"

Transmission ratio of 1st gear is 2.714:1 (example only).


K1 Clutch
Freewheel Clutch
90010680.EPS


Turbine
Impeller
Planet Carrier
Freewheel
Planet Carrier
K1
Turbine Shaft
Small Sun Gear
90010632.EPS

Impeller

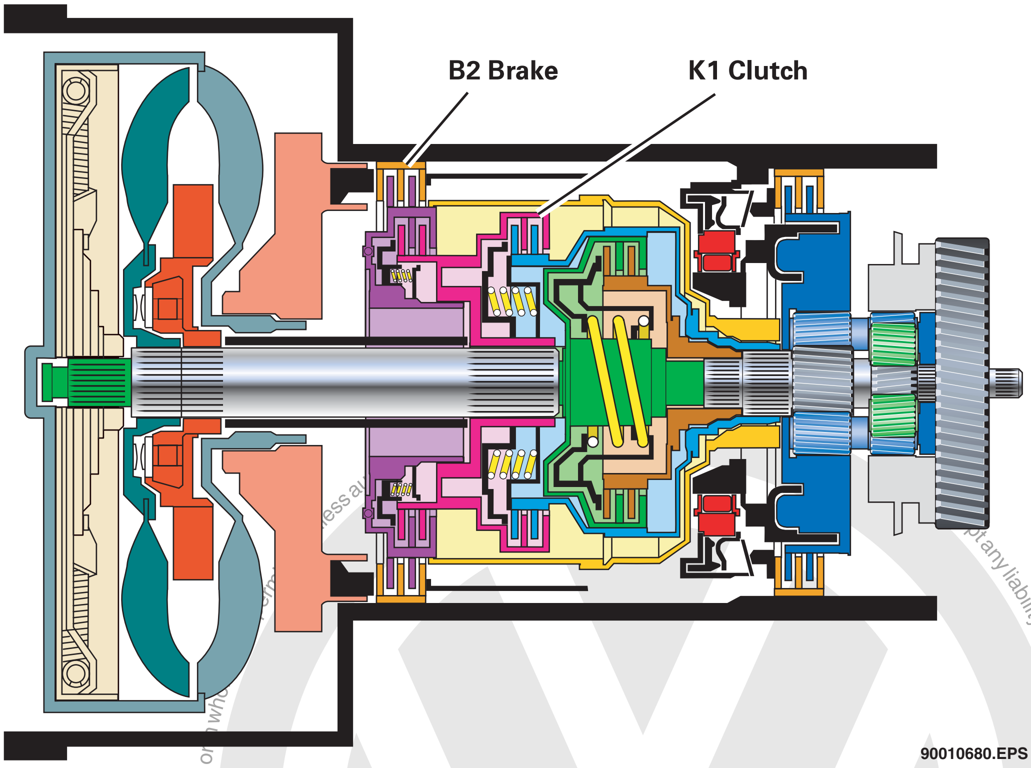
→ Turbine

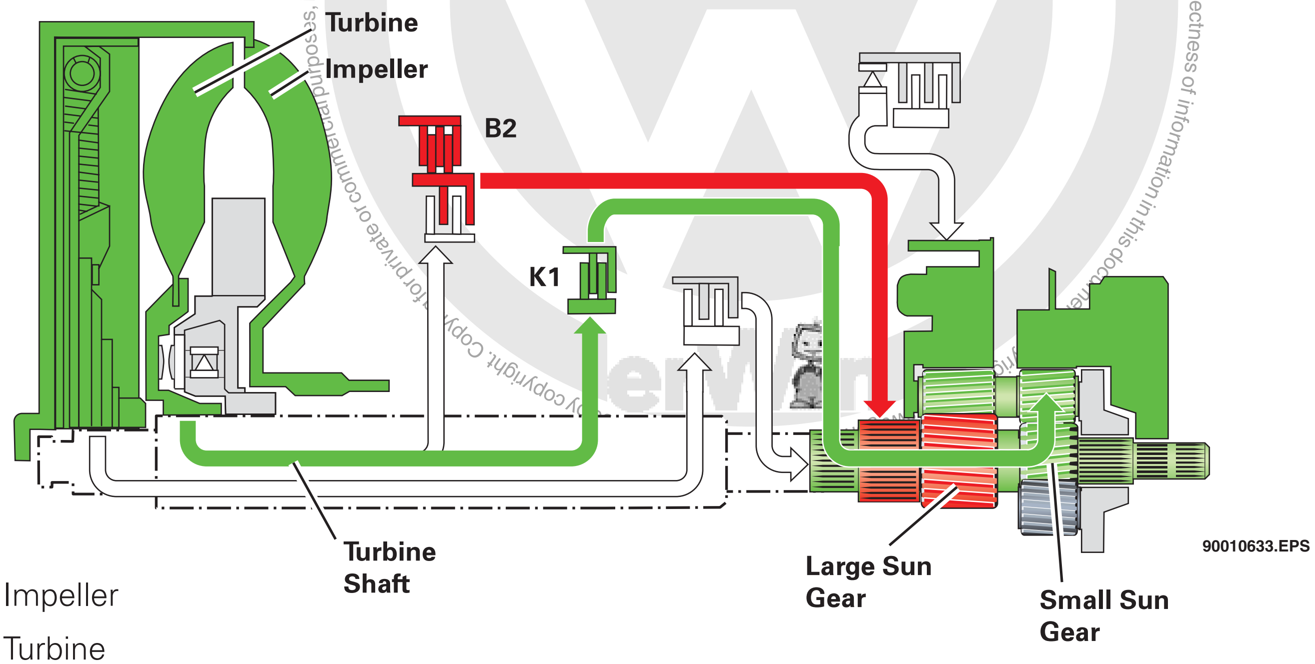
→ Clutch K1 (solenoid valve N88) drives the small sun gear

Planet carrier is held by the freewheel

2nd Gear Hydraulic, Phase 0 and 1
Selector Position “D”

Transmission ratio of 2nd gear is 1.551:1 (example only).


B2 Brake
K1 Clutch
90010680.EPS


Turbine
Impeller
B2
K1
Turbine Shaft
Large Sun Gear
Small Sun Gear
90010633.EPS

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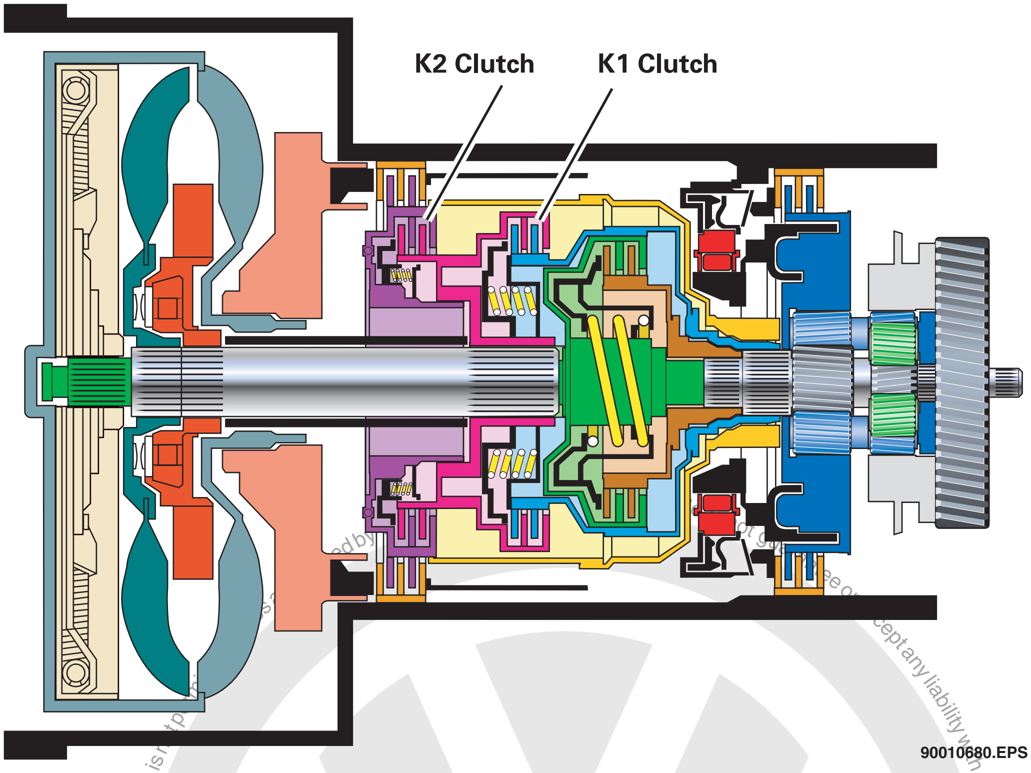
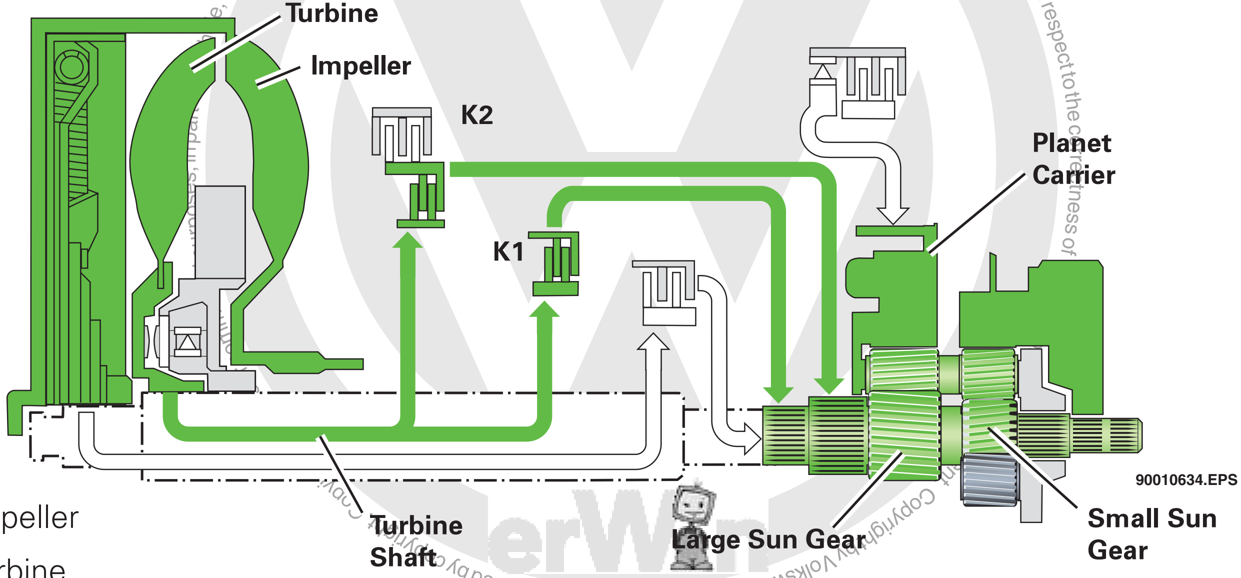
Impeller
→ Turbine
→ Clutch K1 (solenoid valve N88) drives the small sun gear
→ Brake B2 (solenoid valve N89) holds the large sun gear

3rd Gear Hydraulic, Phase 0 and 1
Selector Position "D"

Transmission ratio of 3rd gear is 1.00:1 (example only).


K2 Clutch
K1 Clutch
90010680.EPS

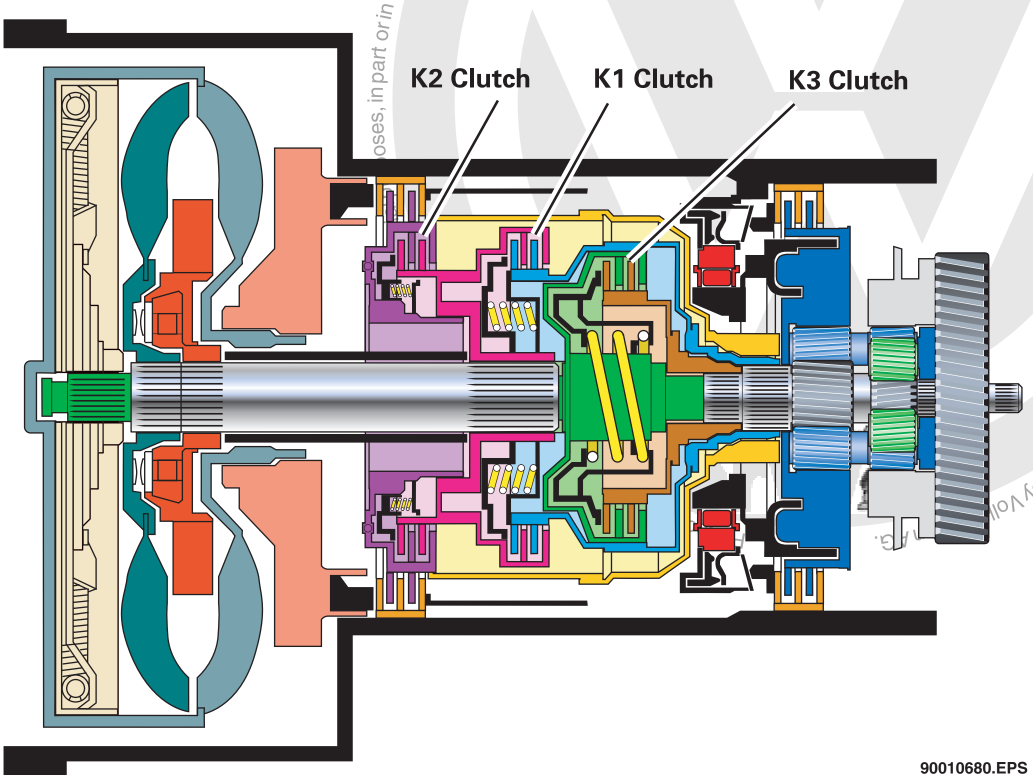

Turbine
Impeller
K2
K1
Planet Carrier
Turbine Shaft
Large Sun Gear
Small Sun Gear
90010634.EPS

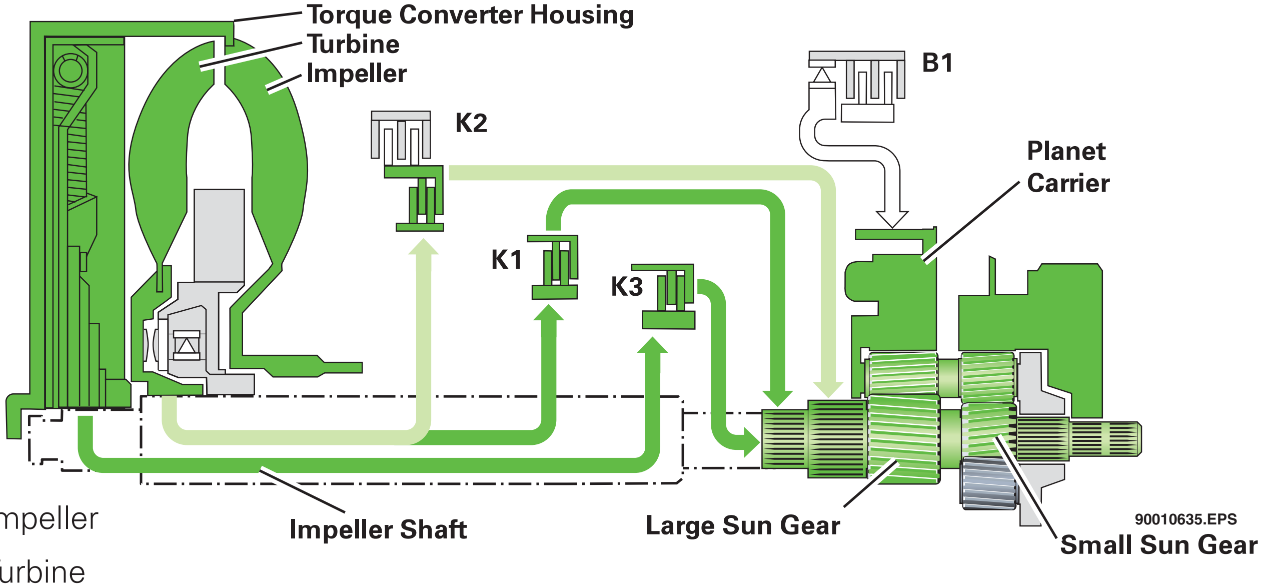
Impeller
→ Turbine
→ Clutch K1 (solenoid valve N88) drives the small sun gear
→ Clutch K2 is closed by the selector lever and drives the large sun gear
→ Planet carrier

As the small sun gear and the large sun gear are driven, the entire planetary gearset rotates.

3rd Gear Mechanical, Phase 0 Only
Selector Position "D"

Transmission ratio of 3rd gear is 1.00:1 (example only).


K2 Clutch
K1 Clutch
K3 Clutch
90010680.EPS


Torque Converter Housing
Turbine
Impeller
K2
B1
Planet Carrier
K1
K3
Impeller Shaft
Large Sun Gear
90010635.EPS
Small Sun Gear

Impeller

→ Turbine

→ Clutch K1 (solenoid valve N88) drives the small sun gear

→ Clutch K2 is closed by the selector lever and drives the large sun gear

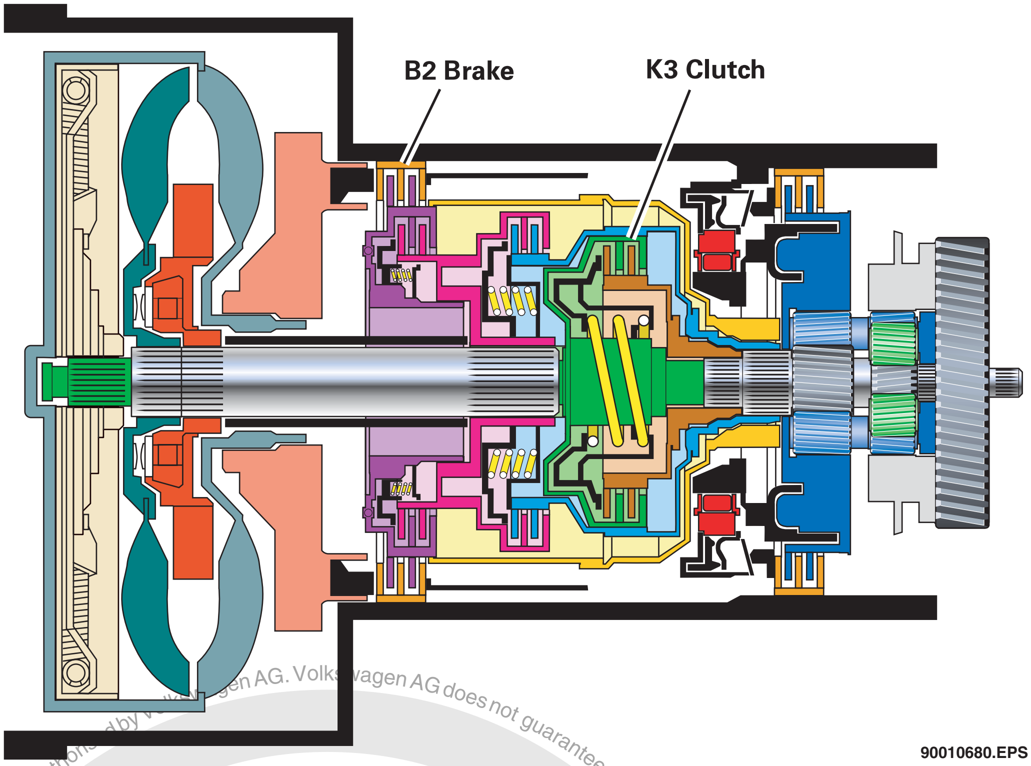
→ Planet carrier

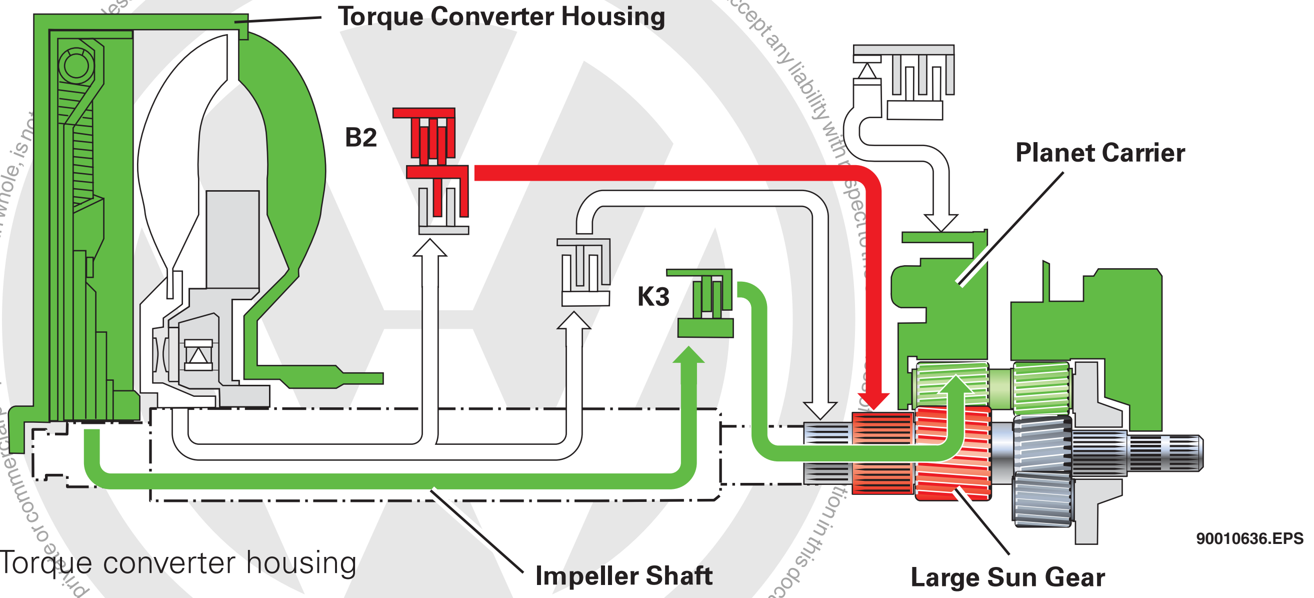
Clutch K3 (solenoid valve N90) locks the planet carrier to the torque converter housing through the impeller shaft.

As the small sun gear and the large sun gear are driven, the entire planetary gearset rotates.

4th Gear Mechanical, Phase 0 and 1
Selector Position “D”

Transmission ratio of 4th gear is 0.697:1 (example only).


B2 Brake
K3 Clutch
90010680.EPS

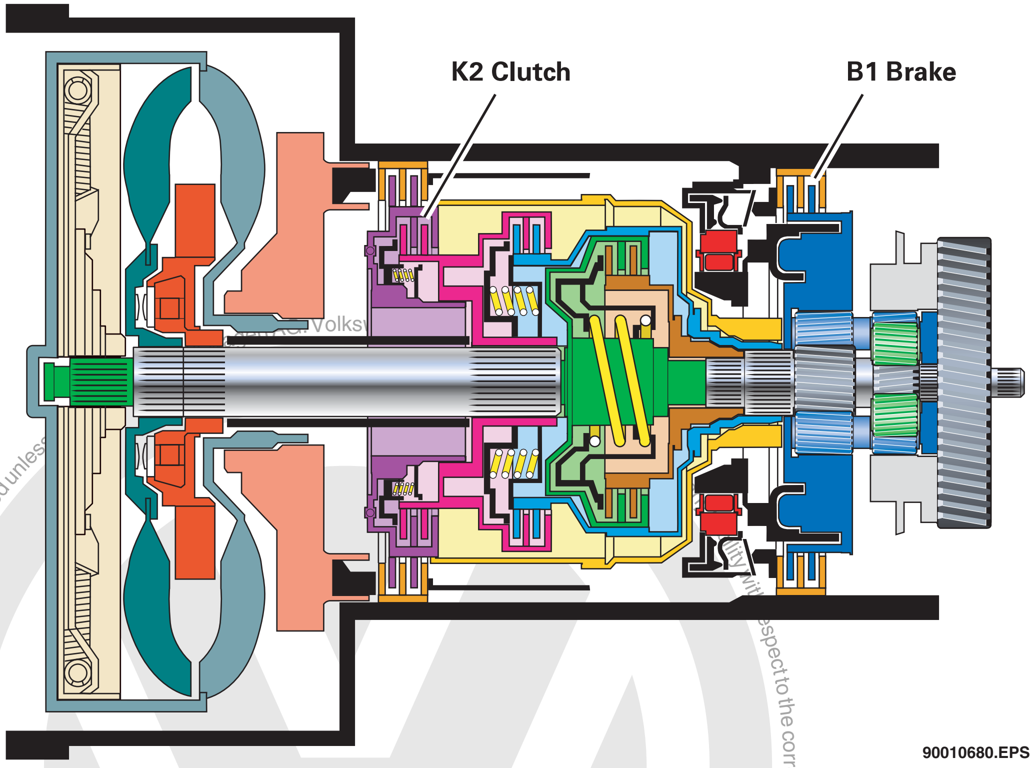

Torque Converter Housing
B2
K3
Planet Carrier
Impeller Shaft
Large Sun Gear
90010636.EPS

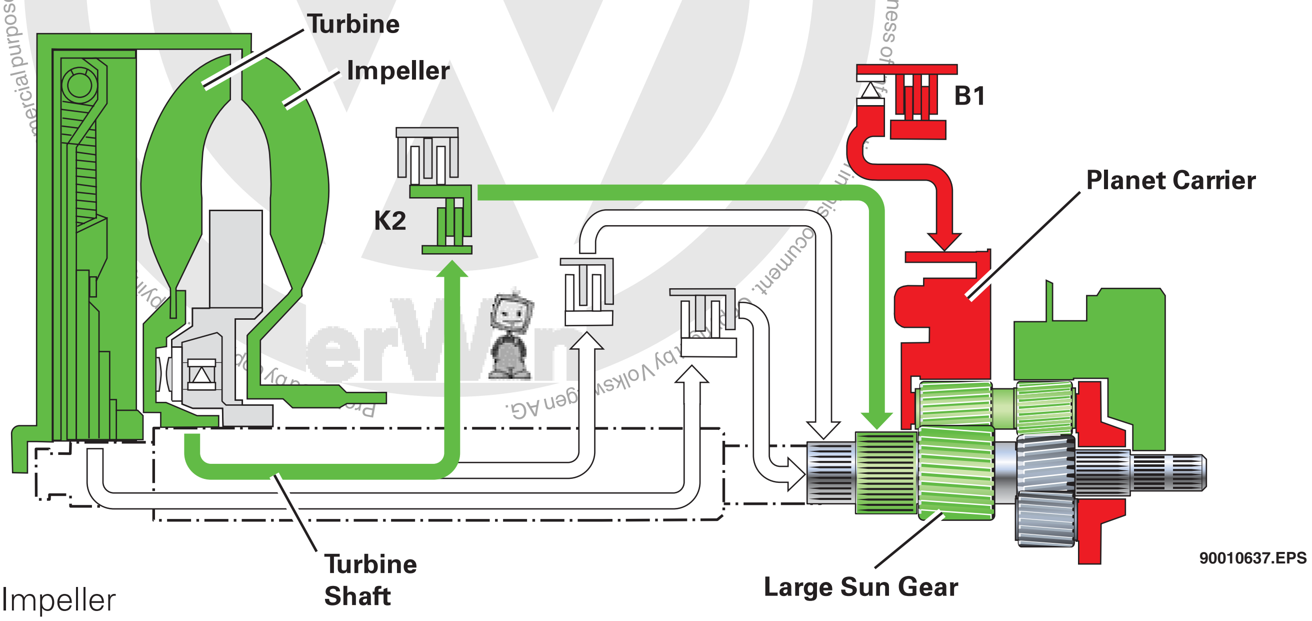
Torque converter housing
→ Impeller shaft
→ Clutch K3 (solenoid valve N90) drives the planet carrier
→ Brake B2 (solenoid valve N89) holds the large sun gear
→ The planetary gearset orbits around the large sun gear

Mechanicals/Hydraulics

Reverse Gear Hydraulic, Phase 0 and 1
Selector Position “R”

Transmission ratio of Reverse is 2.111:1 (example only).


K2 Clutch
B1 Brake
90010680.EPS


Turbine
Impeller
B1
Planet Carrier
K2
Turbine Shaft
Large Sun Gear
90010637.EPS

Impeller

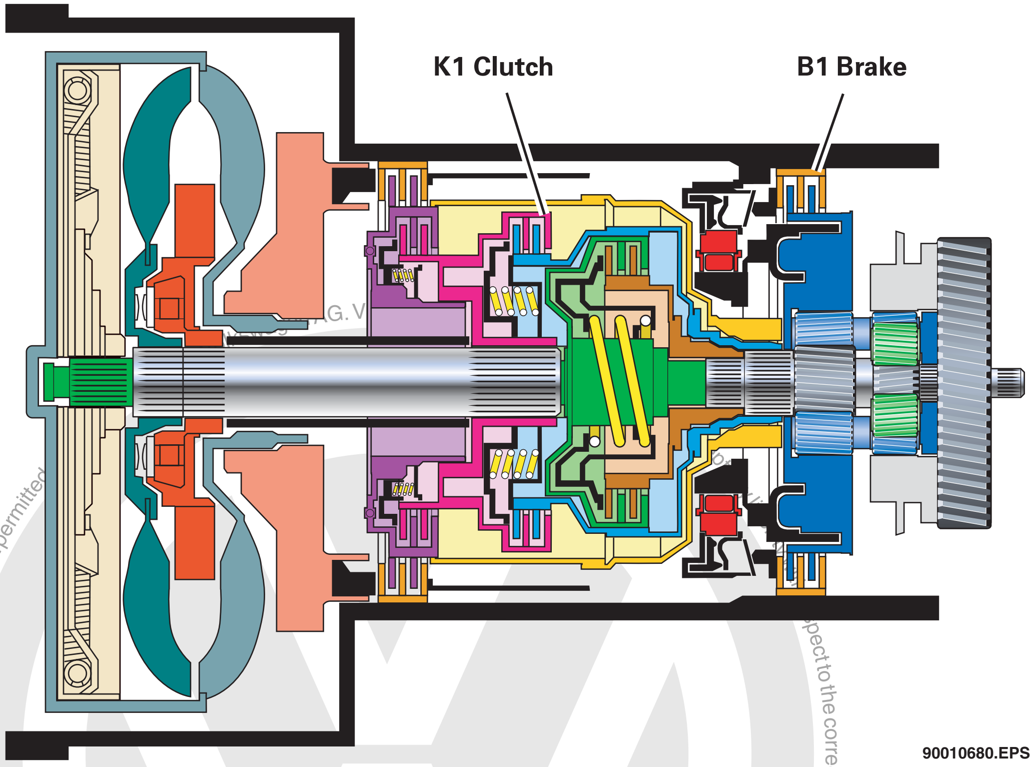
→ Turbine

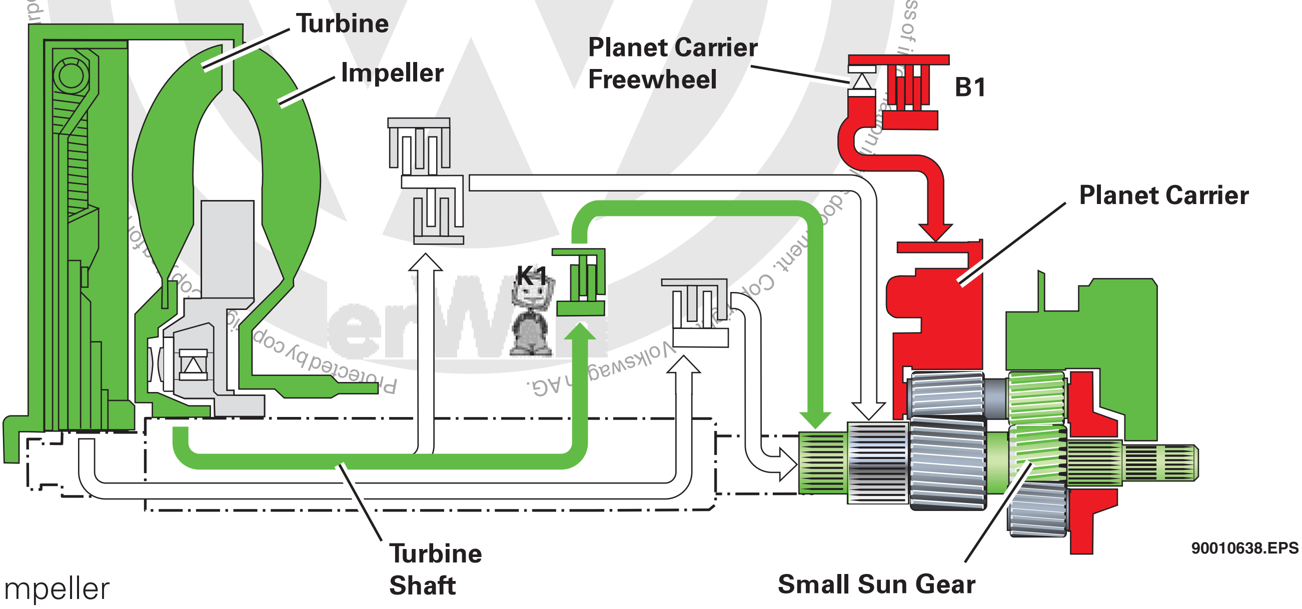
→ Brake B1 (solenoid valve N92) holds the planet carrier

→ Clutch K2 is closed by the selector lever and drives the large sun gear

1st Gear Hydraulic, Phase 0 and 1 Selector Position Manual Low

Transmission ratio of 1st gear is 2.71:1 (example only).


K1 Clutch
B1 Brake
90010680.EPS


Turbine
Impeller
Planet Carrier Freewheel
B1
Planet Carrier
K1
Turbine Shaft
Small Sun Gear
90010638.EPS

Impeller

→ Turbine

→ Clutch K1 (solenoid valve N88) drives the small sun gear

→ Brake B1 (engaged by the selector valve) holds the planet carrier

Mechanicals/Hydraulics

Phase 2 and Phase 2 ETA

The clutches and brakes are operated by the TCM through the solenoid valves in the valve body.

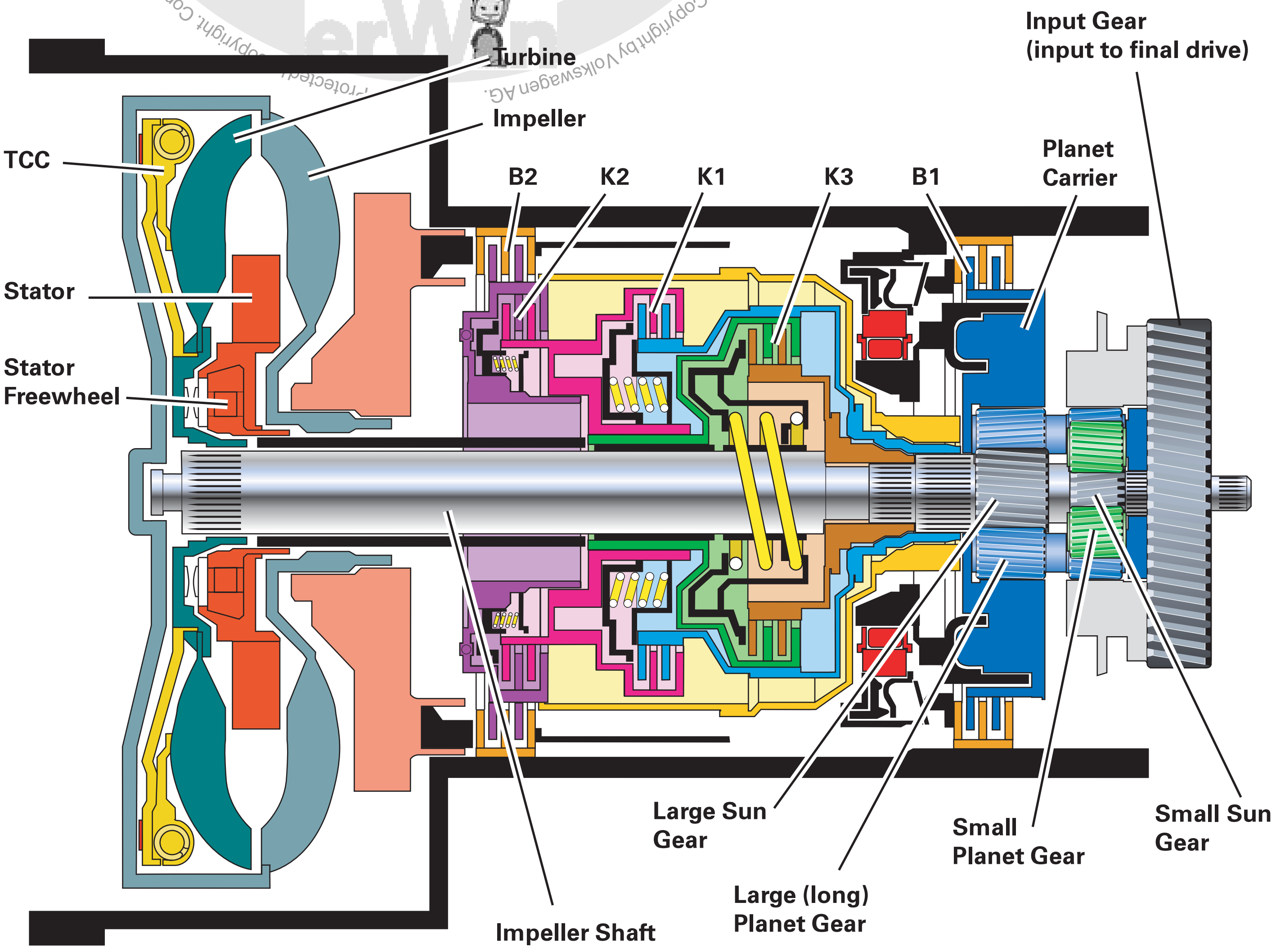
Beginning with Phase 2 transmissions, torque converter lockup is accomplished using the TCC within the torque converter.

Lockup is possible in all gears, but is limited by the TCM to 2nd, 3rd, and 4th.

Power flow through the planetary gearset remains the same, regardless of mechanical or hydraulic operation.

Clutches K1, K2, and K3 pass the power to the planetary gearset.

- Brake B2 holds the large sun gear
- Clutch K2 drives the large sun gear
- Clutch K1 drives the small sun gear
- Clutch K3 drives the planet carrier
- Brake B1 holds the planet carrier

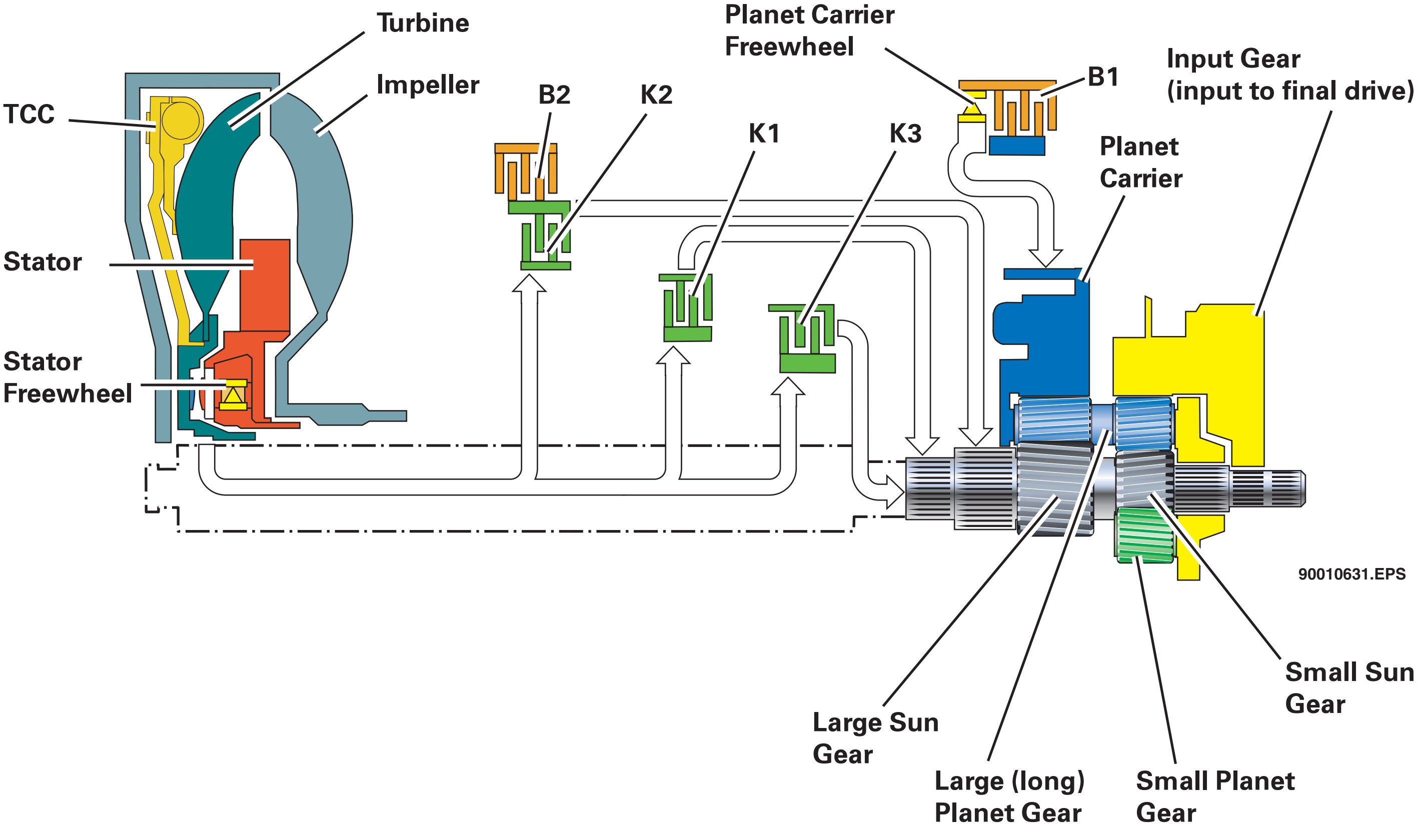

Turbine
Impeller
TCC
Stator
Stator Freewheel
B2
K2
K1
K3
B1
Planet Carrier
Input Gear (input to final drive)
Impeller Shaft
Large Sun Gear
Large (long) Planet Gear
Small Planet Gear
Small Sun Gear

90010647.EPS

Power flows are illustrated using the same type of schematics used for the Phase 0 and Phase 1 transmissions.

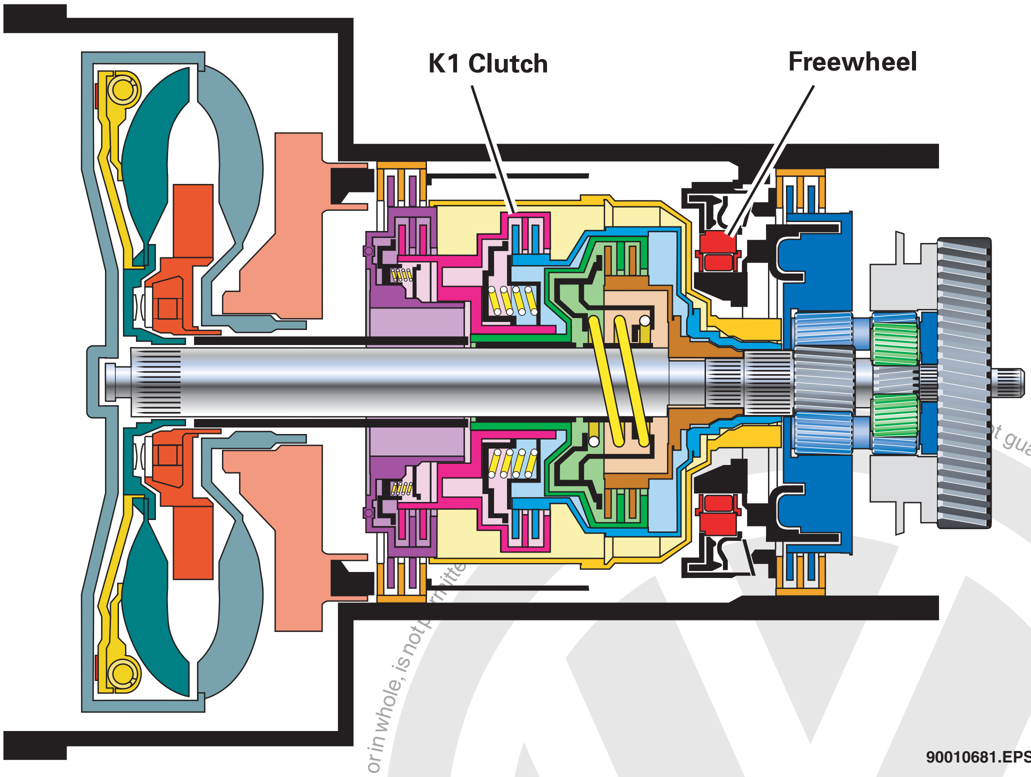
Only the active components are ‘called out’.

Gear ratios are given as examples only. Actual ratios vary with application. Always refer to current service information for the most accurate specifications.

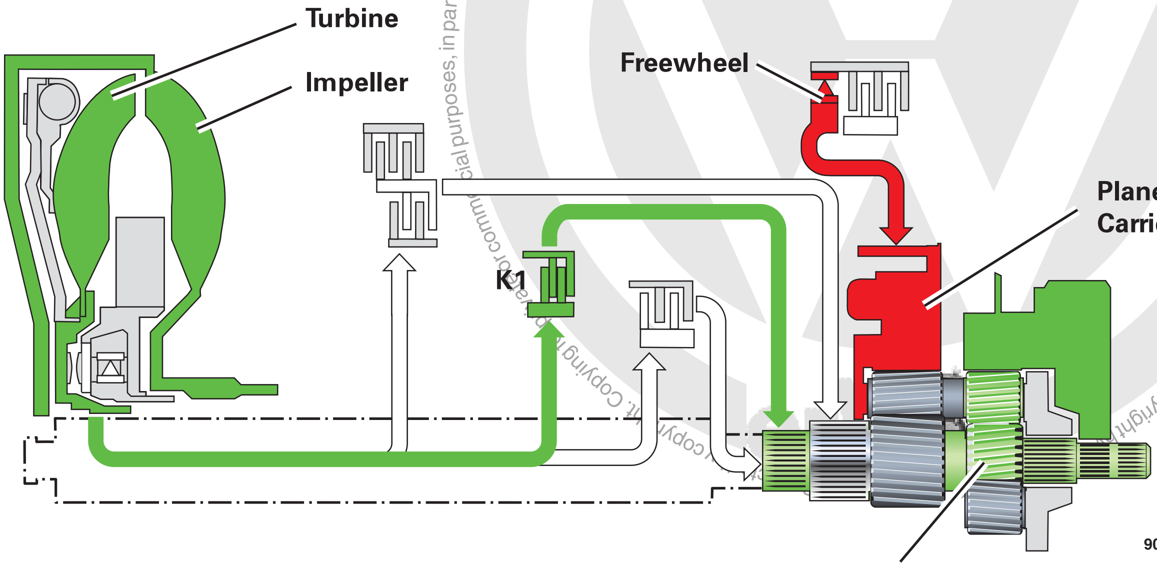

Turbine
Impeller
TCC
Stator
Stator Freewheel
B2
K2
K1
K3
Planet Carrier Freewheel
B1
Input Gear (input to final drive)
Planet Carrier
90010631.EPS
Small Sun Gear
Large Sun Gear
Large (long) Planet Gear
Small Planet Gear

1st Gear Hydraulic, Phase 2 and Phase 2 ETA
Selector Position "D"

Transmission ratio of 1st gear is 2.71:1 (example only).


K1 Clutch
Freewheel

90010681.EPS

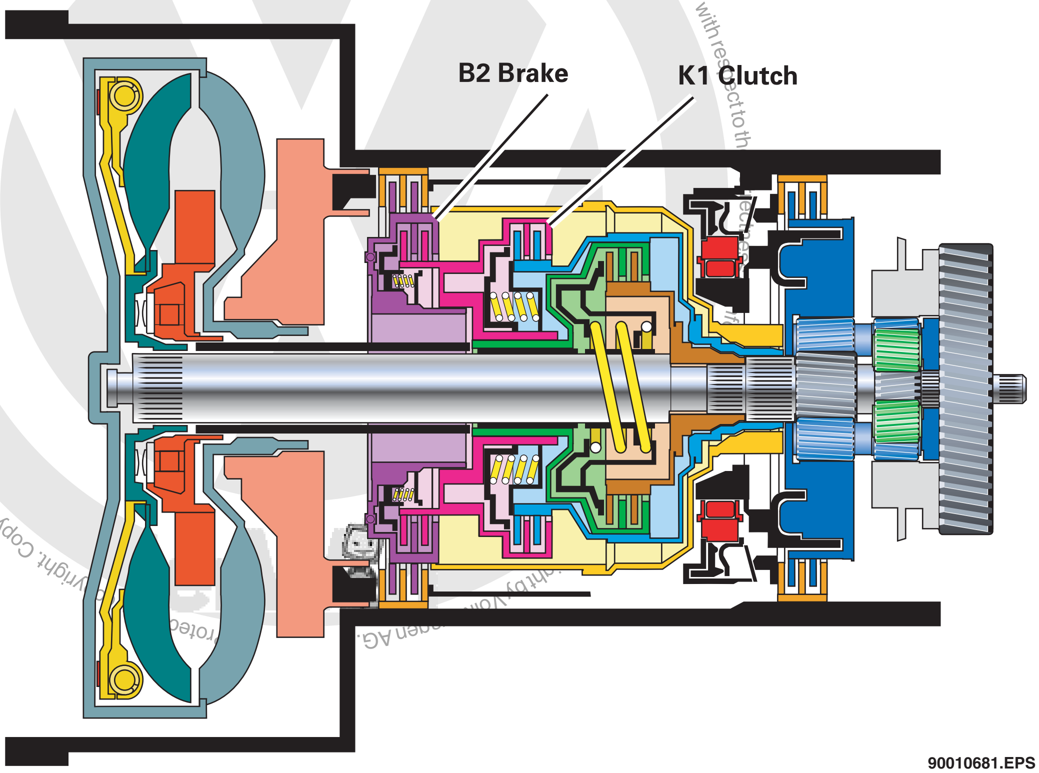

Turbine
Impeller
Freewheel
K1
Planet Carrier
Small Sun Gear

90010639.EPS

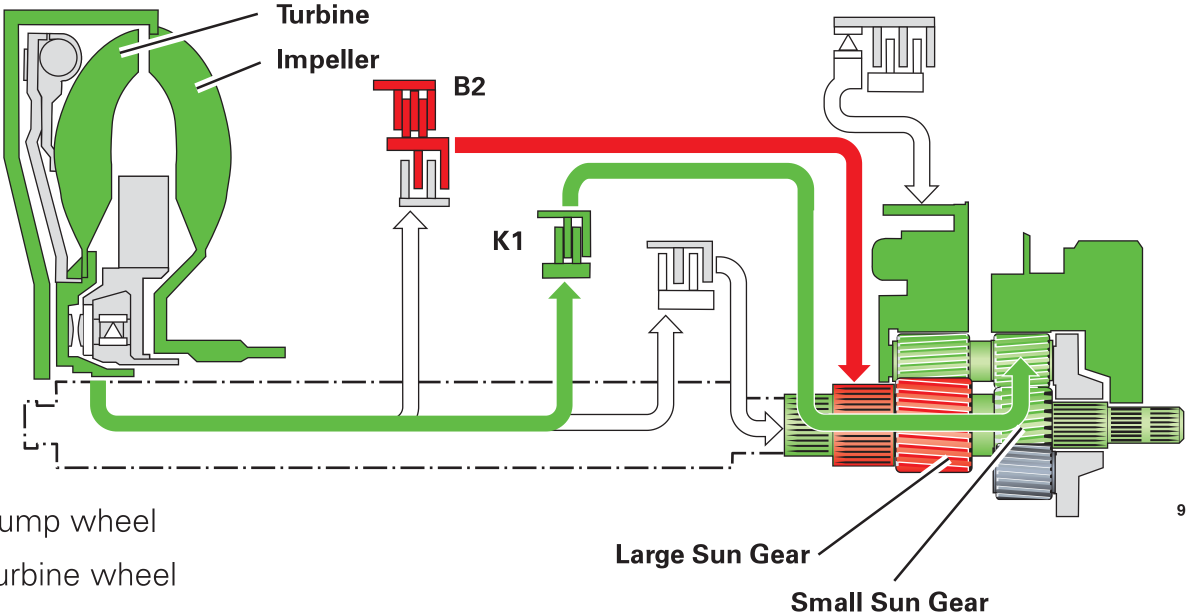
Pump wheel
→ Turbine Wheel
→ Clutch K1 (solenoid valve N88)
→ Drives the small sun wheel
→ The planet carrier is held by the freewheel

2nd Gear Hydraulic, Phase 2 and Phase 2 ETA Selector Position "D"

Transmission ratio of 2nd gear is 1.44:1 (example only).


B2 Brake
K1 Clutch

90010681.EPS

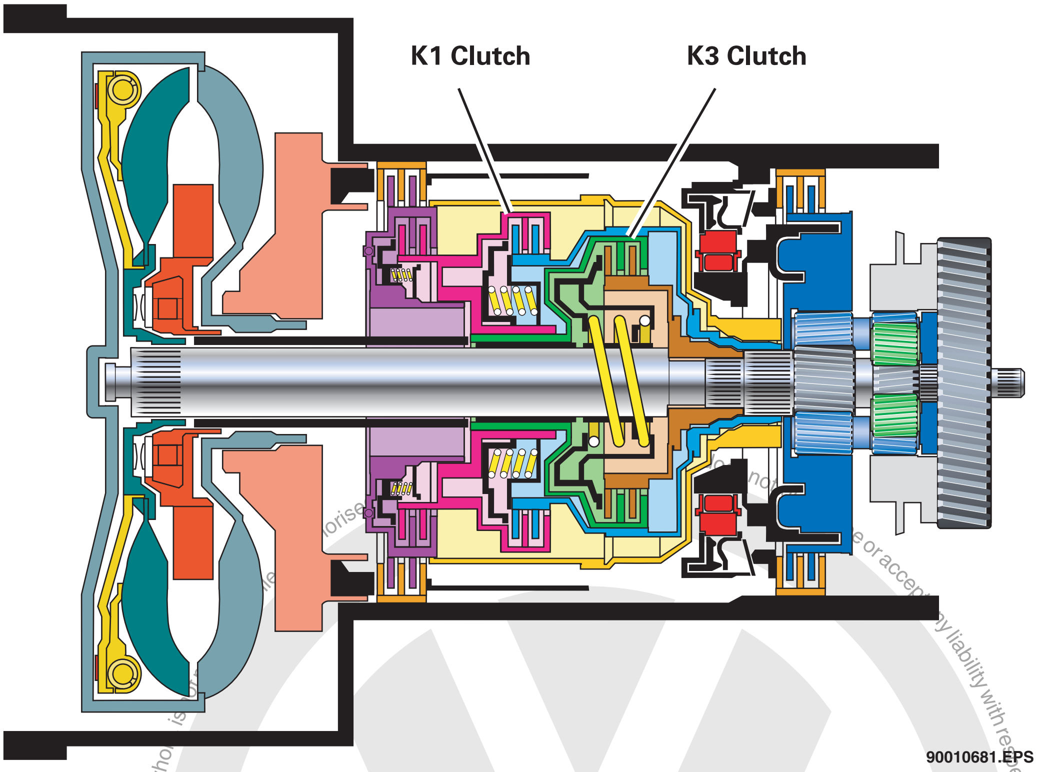

Turbine
Impeller
B2
K1
Large Sun Gear
Small Sun Gear

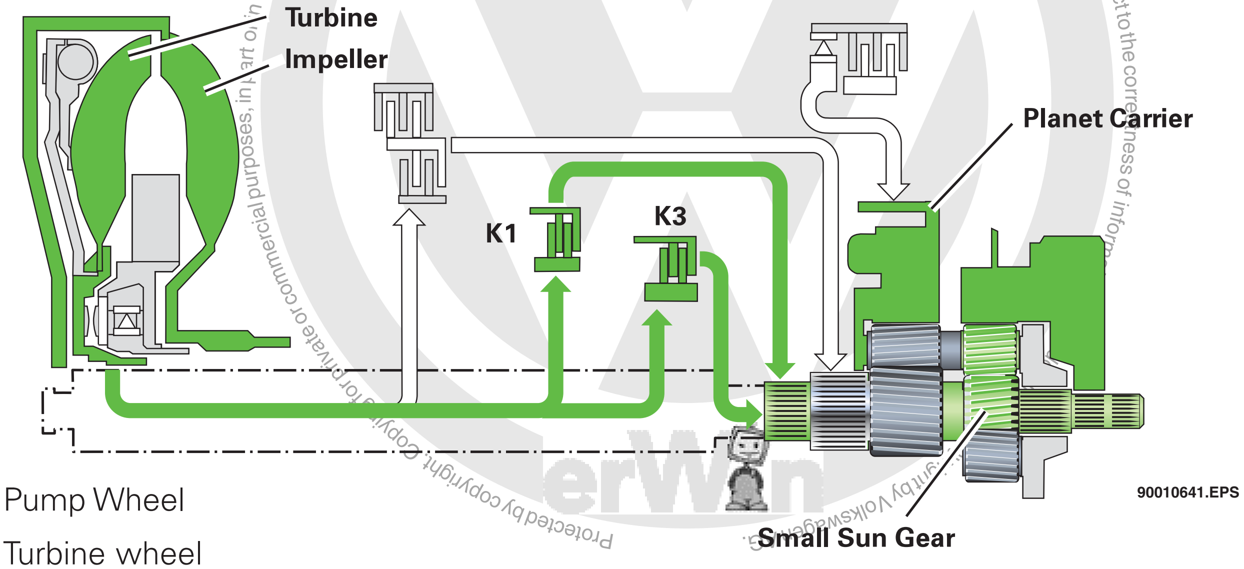
90010640.EPS

Pump wheel
→ Turbine wheel
→ Clutch K1 (solenoid valve N88)
→ Drives the small sun gear
→ Brake B2 (solenoid valve N89)
→ Holds the large sun gear

3rd Gear Hydraulic, Phase 2 and Phase 2 ETA Selector Position "D"

Transmission ratio of 3rd gear is 1.0:1 (example only).


K1 Clutch
K3 Clutch
90010681.EPS


Turbine
Impeller
Planet Carrier
K1
K3
90010641.EPS
Small Sun Gear

Pump Wheel

Turbine wheel

Clutch K1 (solenoid valve N88)

Small sun wheel

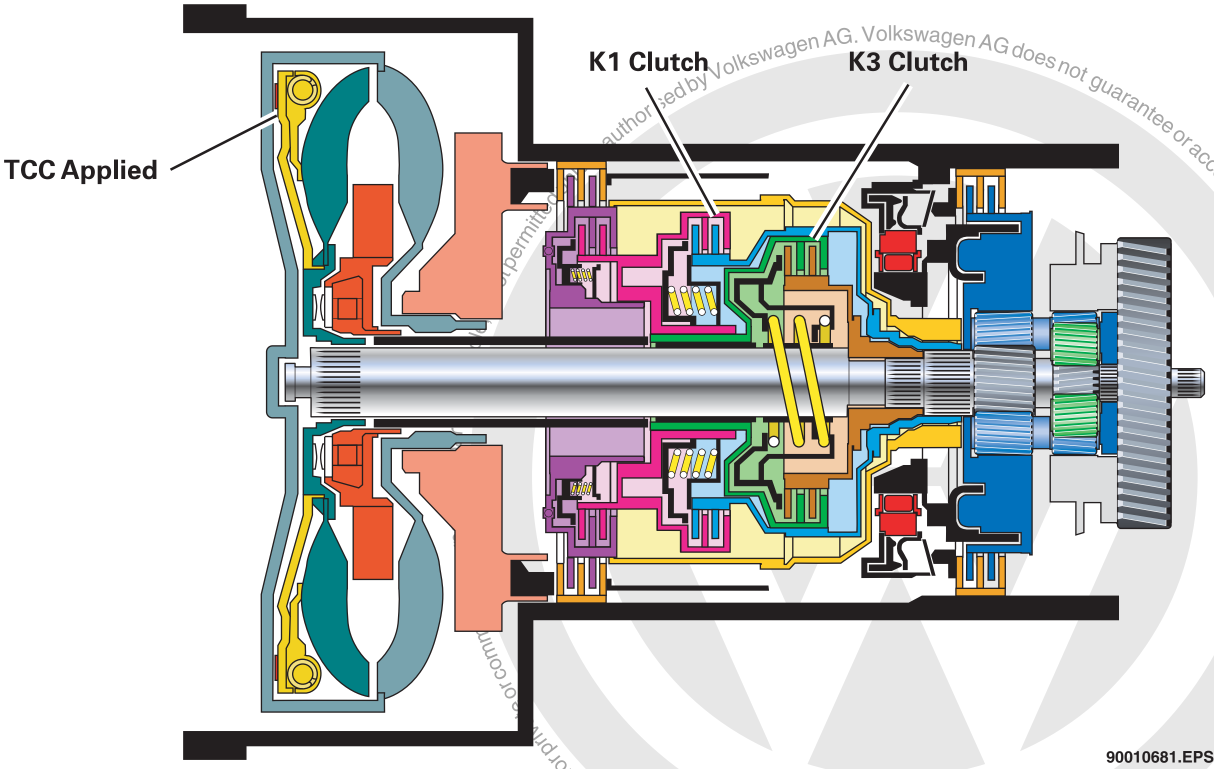
Clutch K3 (solenoid valve N90)

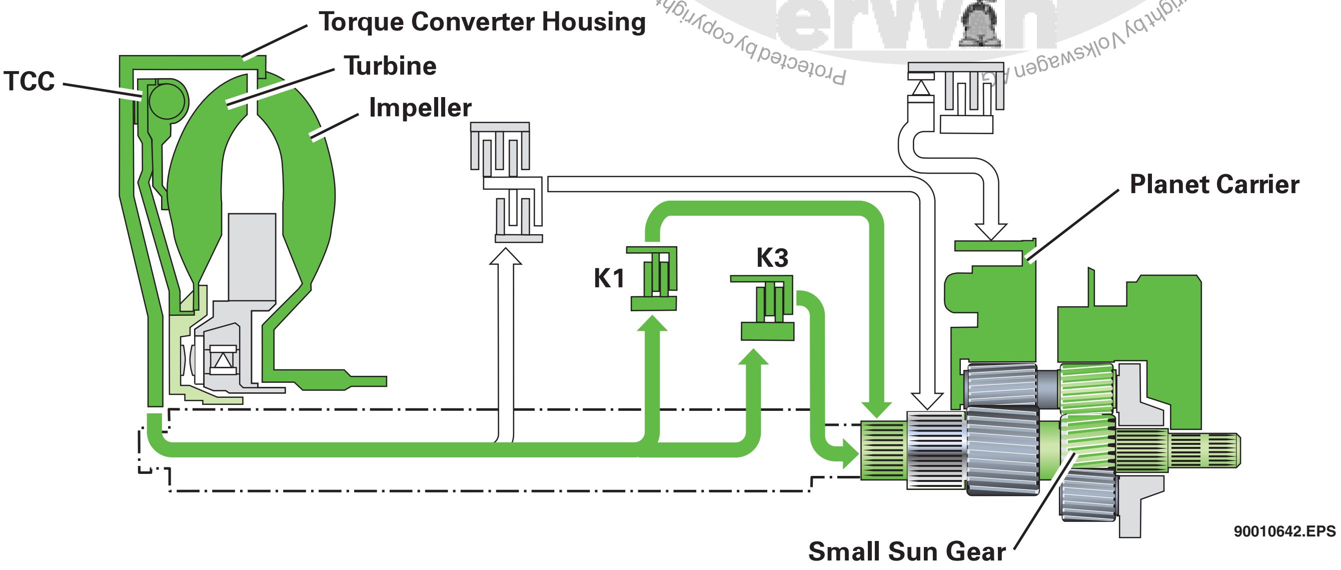
Planet carrier

As the small sun wheel and the planet carrier are driven, the entire planetary gearset rotates.

3rd Gear Mechanical, Phase 2 and Phase 2 ETA Selector Position “D”

Transmission ratio of 3rd gear is 1.0:1 (example only).


K1 Clutch
K3 Clutch
TCC Applied
90010681.EPS


Torque Converter Housing
TCC
Turbine
Impeller
Planet Carrier
K1
K3
Small Sun Gear
90010642.EPS

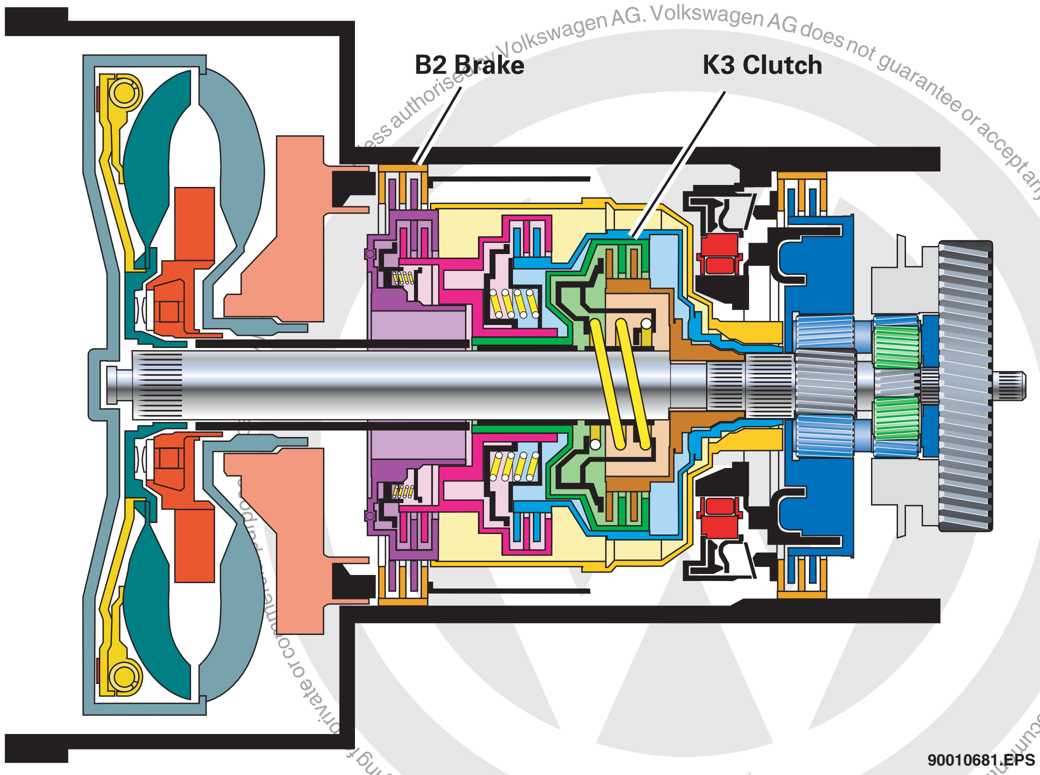
Torque converter housing

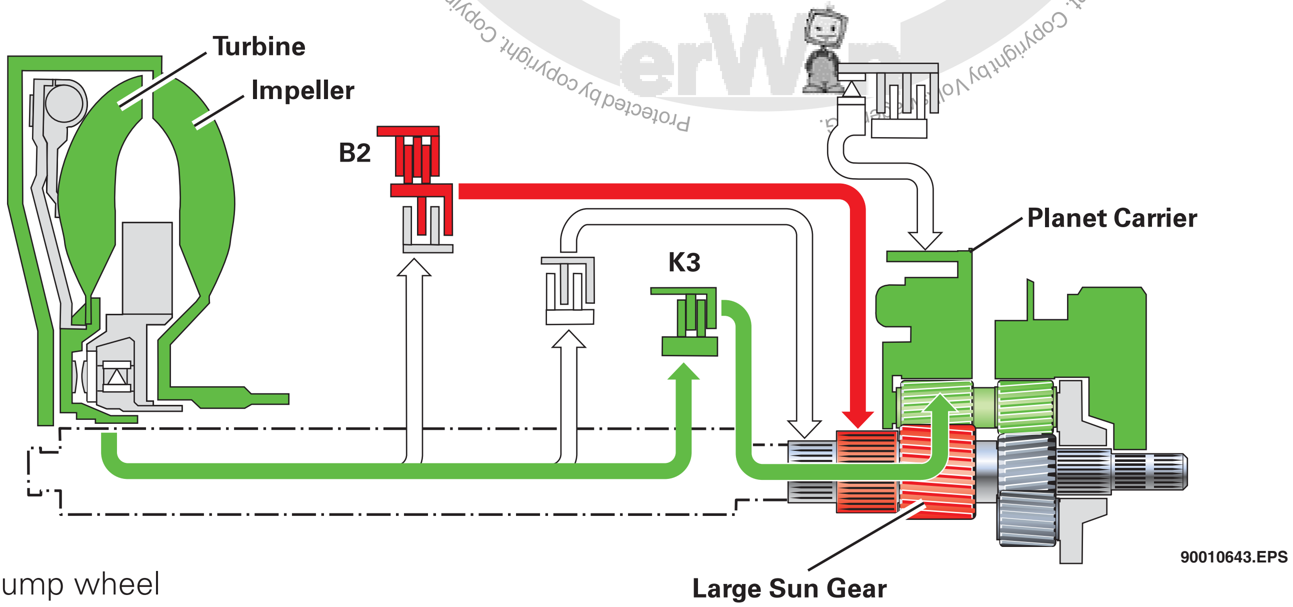
→ TCC (modulation valve N91)

→ Remaining power transmission is identical to the hydraulic power flow for 3rd gear

4th Gear Hydraulic, Phase 2 and Phase 2 ETA Selector Position “D”

Transmission ratio of 4th gear is 0.74:1 (example only).


B2 Brake
K3 Clutch
90010681.EPS


Turbine
Impeller
B2
K3
Planet Carrier
Large Sun Gear
90010643.EPS

Pump wheel

→ Turbine wheel

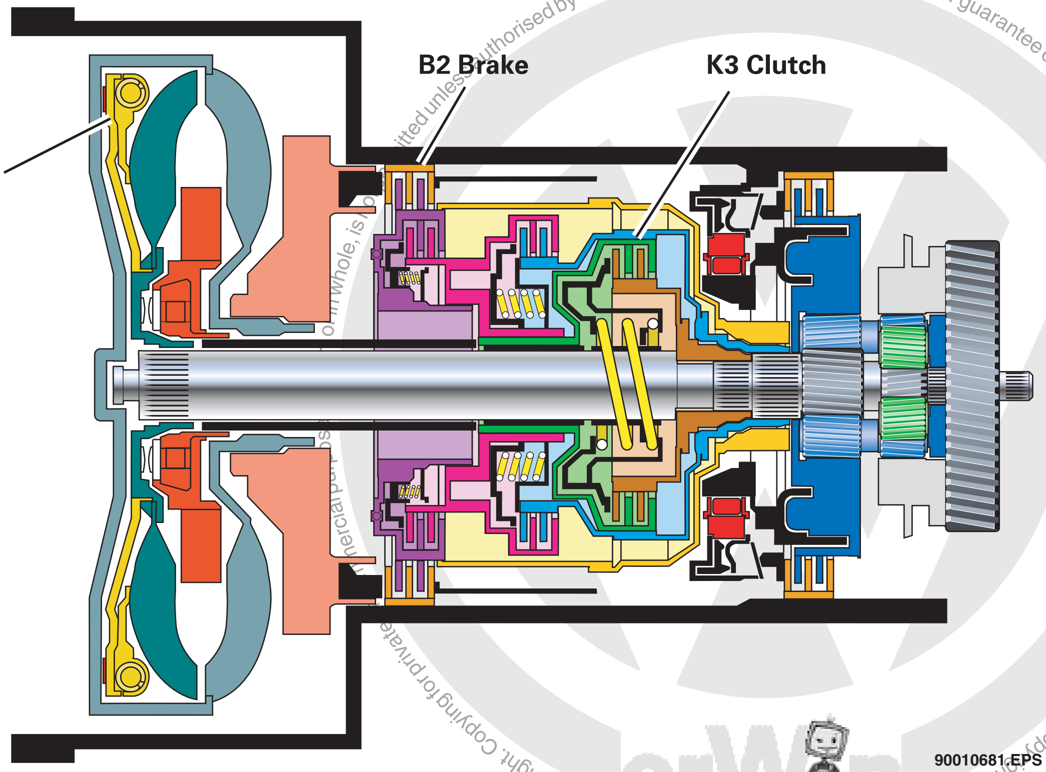
→ Brake B2 holds the large sun wheel (solenoid valve N89)

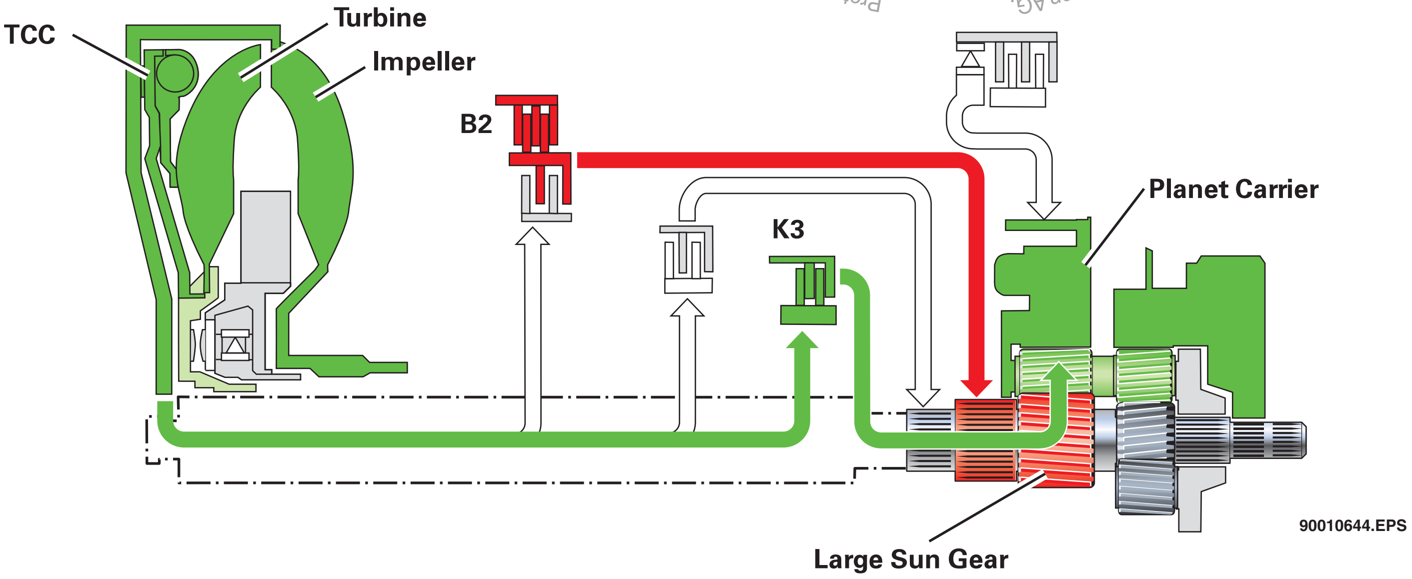
→ Clutch K3 drives the planet carrier (solenoid valve N90)

The planetary gearset orbits around the large sun gear

4th Gear Mechanical, Phase 2 and Phase 2 ETA Selector Position "D"

Transmission ratio of 4th gear is 0.74:1 (example only).


B2 Brake
K3 Clutch
TCC Applied
90010681.EPS


TCC
Turbine
Impeller
B2
K3
Planet Carrier
Large Sun Gear
90010644.EPS

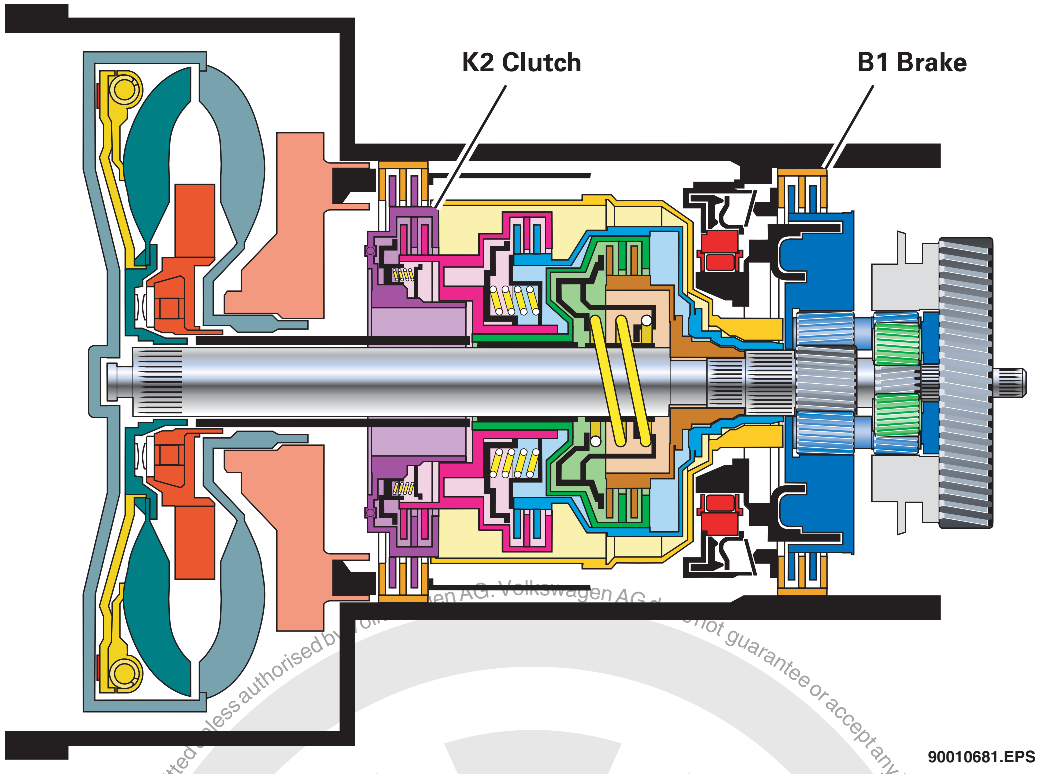
Torque converter housing

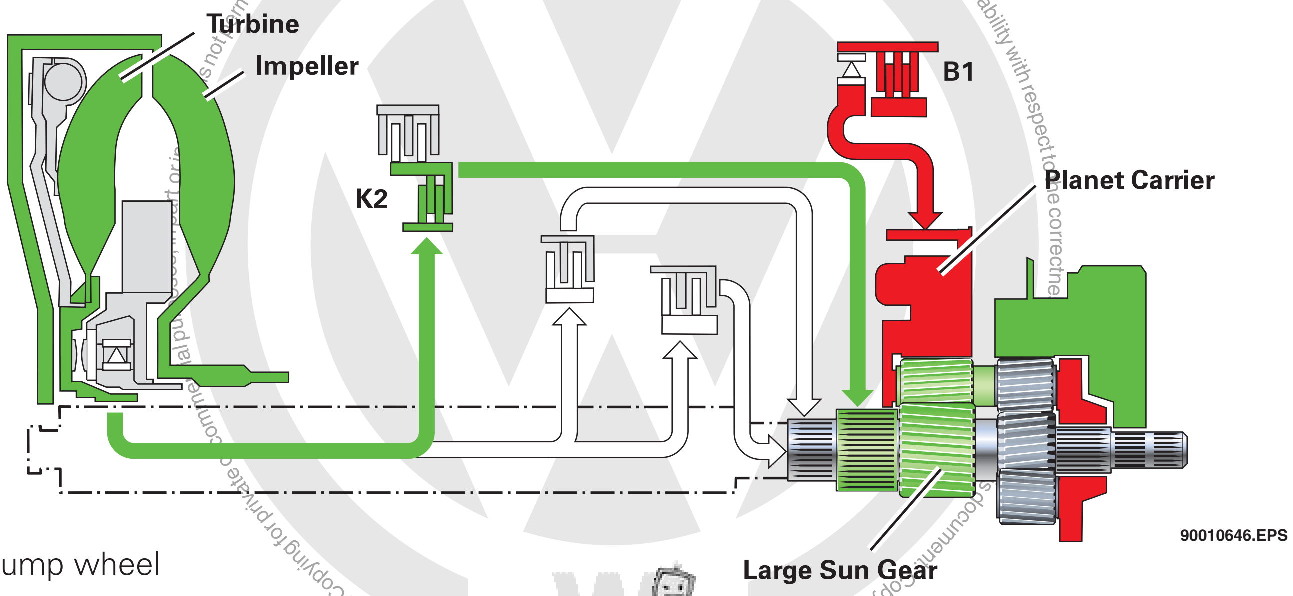
→ TCC (modulation valve N91)

→ Remaining power transmission is identical to the hydraulic power flow

Reverse Gear, Phase 2 and Phase 2 ETA

Transmission ratio of Reverse gear is 2.88:1 (example only).


K2 Clutch
B1 Brake
90010681.EPS


Turbine
Impeller
K2
B1
Planet Carrier
Large Sun Gear
90010646.EPS

Pump wheel

→ Turbine wheel

→ Brake B1 holds the planet carrier (solenoid valve N92)

→ Clutch K2 is closed by the selector lever

→ The large sun gear is driven

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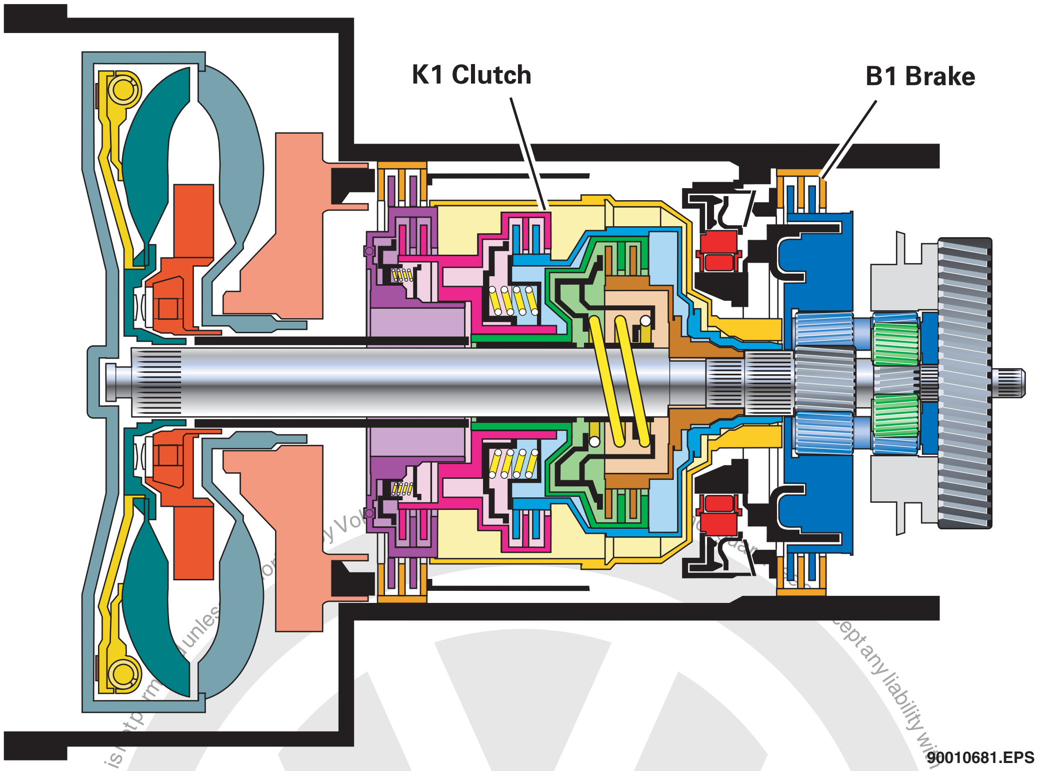
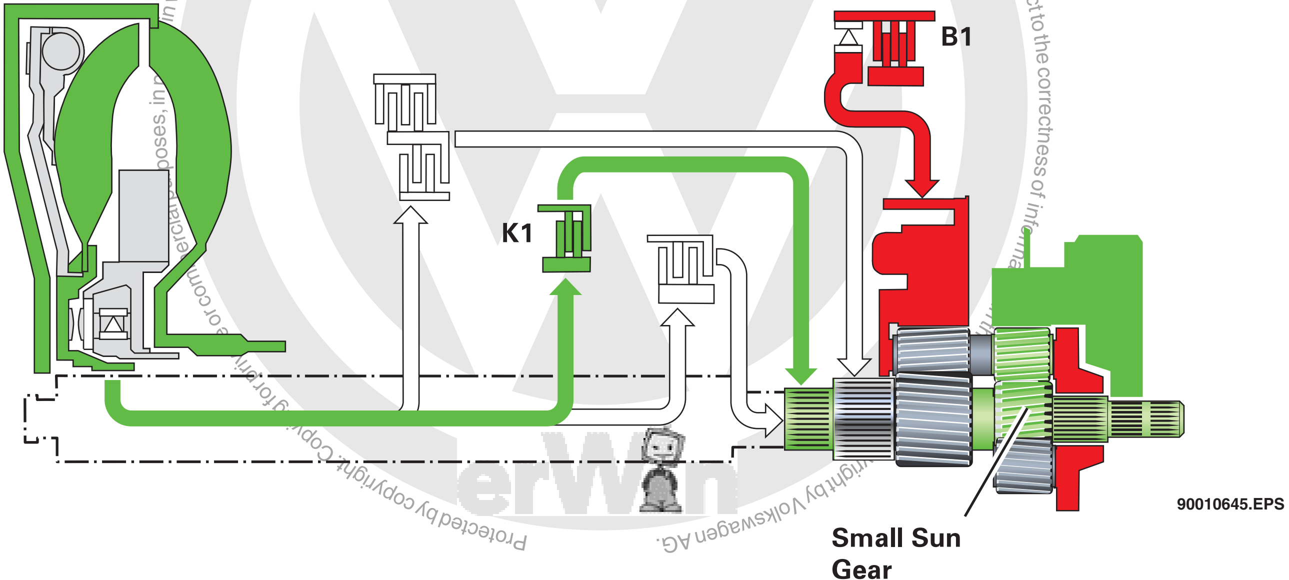
1st Gear Hydraulic, Phase 2 and Phase 2 ETA Selector Position Manual Low

Transmission ratio of 1st gear is 2.71:1 (example only).


K1 Clutch
B1 Brake
90010681.EPS


B1
K1
Small Sun Gear
90010645.EPS

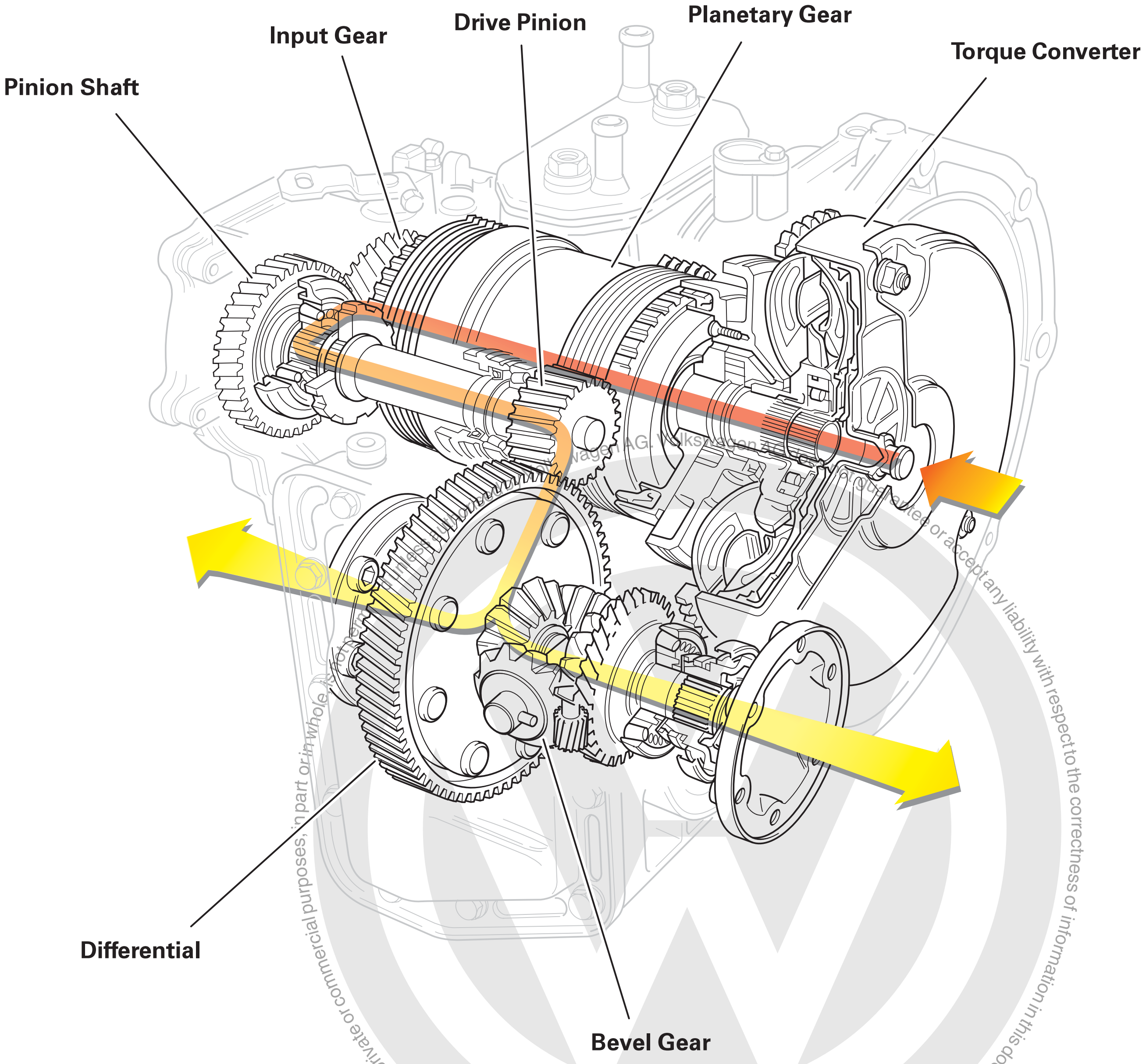
Impeller

Turbine

Brake B1 holds the planet carrier (solenoid valve N92)

Clutch K1 is closed by the selector lever and the large sun wheel is driven

Final Drive (all phases)


Pinion Shaft
Input Gear
Drive Pinion
Planetary Gear
Torque Converter
Differential
Bevel Gear

90010654.EPS

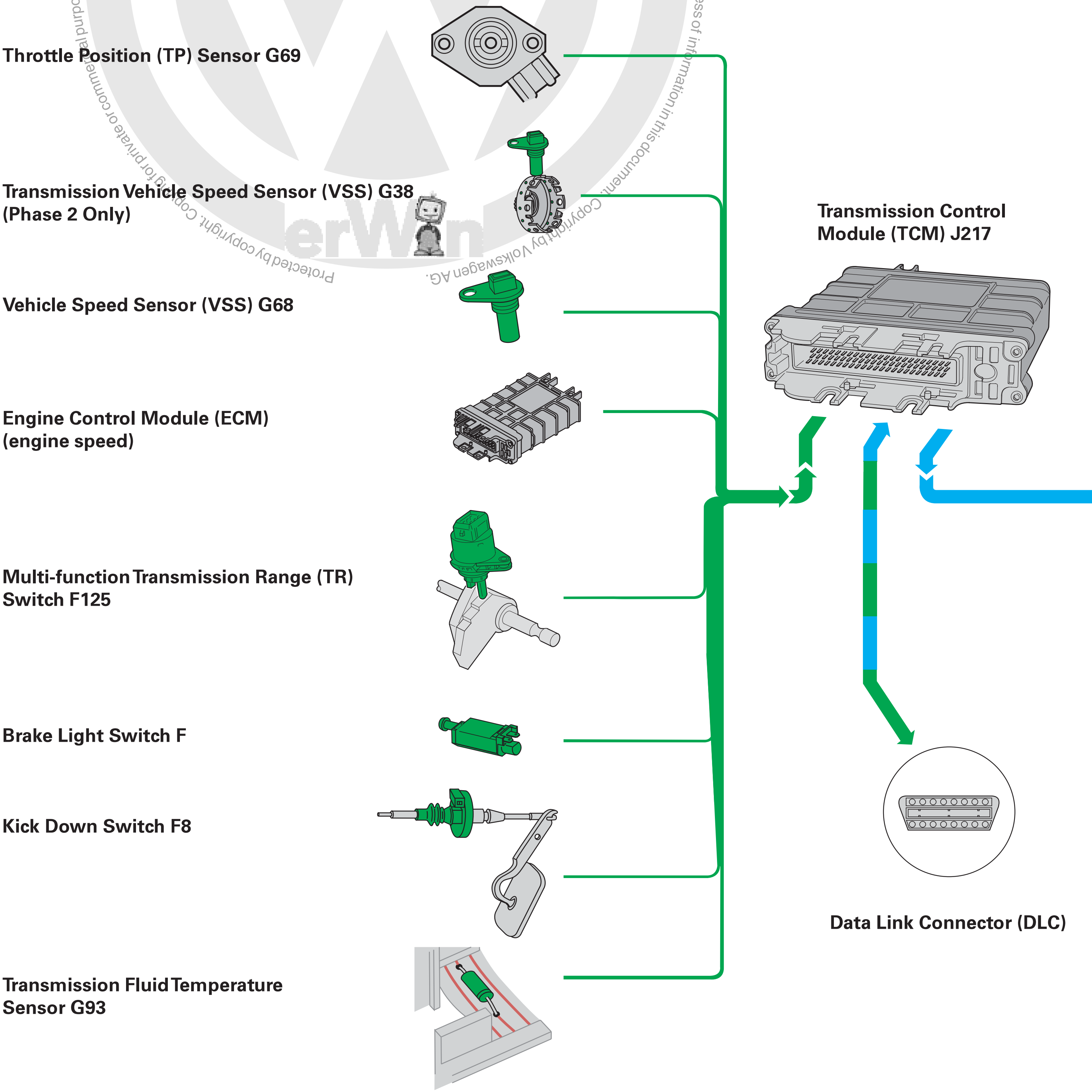
Planetary gear
→ Input gear (ring gear of planetary gearset)
→ Pinion shaft
→ Drive pinion
→ Differential
→ Axles

Notes:

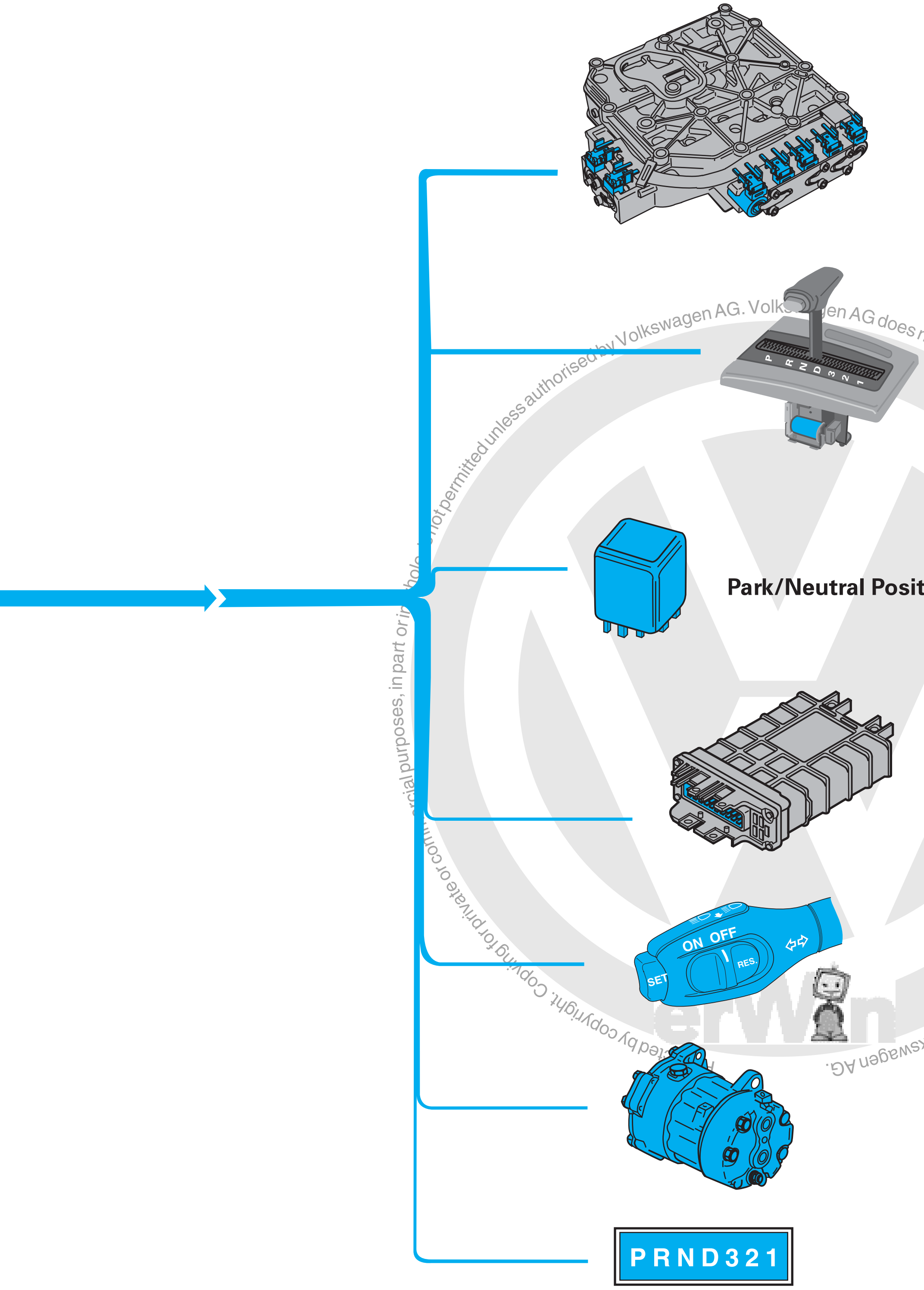
Component Identification (example)

Sensors

Sensors and actuators shown are typical. Actual components will vary by application.


Throttle Position (TP) Sensor G69
Transmission Vehicle Speed Sensor (VSS) G38 (Phase 2 Only)
Vehicle Speed Sensor (VSS) G68
Engine Control Module (ECM) (engine speed)
Multi-function Transmission Range (TR) Switch F125
Brake Light Switch F
Kick Down Switch F8
Transmission Fluid Temperature Sensor G93
Transmission Control Module (TCM) J217
Data Link Connector (DLC)

Actuators


P R N D 3 2 1
ON OFF
SET
RES.
P R N D 3 2 1

Valve Body with the Solenoid Valves N88-N94

Shift Lock Solenoid N110

Park/Neutral Position (PNP) Relay J226

Additional Signals

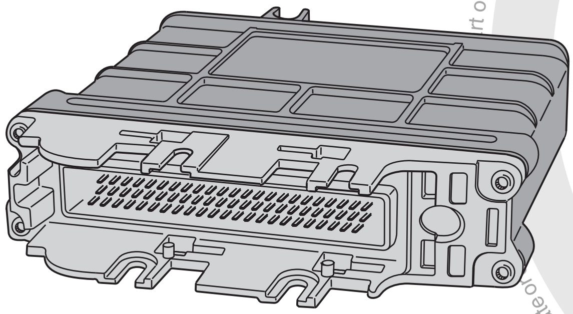
Engine Control Module (ECM)

Cruise Control System

Air Conditioning

Selector Lever Display

90010611.EPS



90010655.EPS

Transmission Control Module J217

The Transmission Control Module (TCM) J217 is the electronic command center of the four-speed automatic. It controls all the electrical, and thus all the hydraulic operations of the transmission.

The TCM also establishes driving programs based on an individual's driving style and driving situations. Determined by "fuzzy logic", shift points are moved to higher or lower engine rpm, based on the individual's driving style.

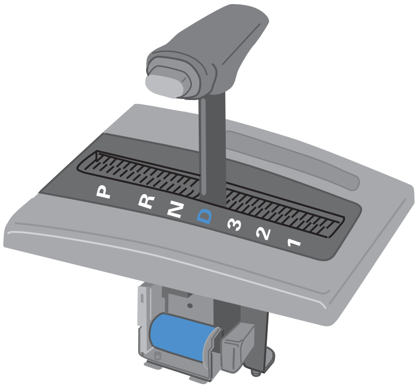
Various types of driving resistances such as climbing a hill, towing a trailer, driving into a stiff wind, as well as descending a hill are recognized and accounted for by the TCM's "fuzzy logic".

Self Diagnosis

The four-speed automatic computer systems include self-diagnostic capabilities. These self-diagnostics use the computer to examine many of the parameters in the system and identify problems.

The TCM can check the electrical system during normal operation and store codes in memory to identify any faults it encounters.

Emergency Running Mode



90010601.EPS

Failures in certain sensors and/or actuators can result in damage to the transmission. The TCM will recognize this and default to an emergency running mode. By operating the selector lever, the following gears engage mechanically in the valve body:

- 1st gear hydraulic
- 3rd gear hydraulic
- Reverse gear

When the selector lever is in the Drive position, the vehicle will start off in 3rd gear hydraulic. First gear hydraulic is available by moving the selector lever to "1".

Determining the Shift Point

Phase 0 and 1

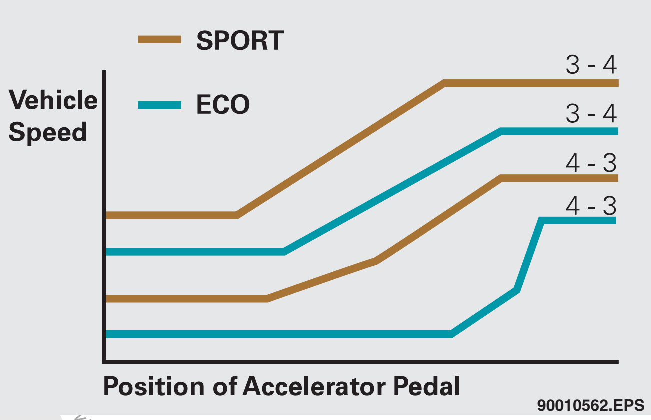
In the Phase 0 transmission, gears are selected on the basis of shift maps. A shift characteristic curve is stored for each gear change based on the position of the accelerator pedal and the speed of the vehicle.

In 1990, the Phase 0 transmissions used an ECO/SPORT switch, which allowed the driver to choose between two shift maps:

- The ECO shift map provided early upshifting and late downshifting, for better fuel economy
- The Sport shift map provided shifting up and down at higher vehicle speed and rpm level, for higher performance

This selection was automated in 1993 and the switch between “ECO” and “SPORT” was based on the speed at which the accelerator pedal was operated. The manual switch was replaced by an electronic program switch in the TCM.

As with the previous system, this was still a strict decision between “ECO” or “SPORT”.



This diagram illustrates only the 3rd to 4th gearshift.

ECO = Shifting up early and shifting down late = low rpm level = good fuel economy

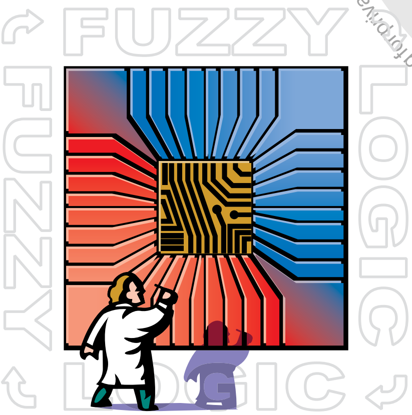
SPORT = With the same accelerator pedal position, shifting up and down at a higher vehicle speed = higher rpm level = greater performance

Model Year 95 to Current

The electronic program switch in the TCM has been replaced by a shift program based on the driver's style and the driving situation.

The driving resistance-based shift program recognizes driving resistances such as climbing or descending a hill, towing a trailer, and driving into the wind. The TCM calculates the driving resistance on the basis of the speed of the vehicle, the position of the throttle valve, the engine speed, and the acceleration of the vehicle and uses this as the basis for specifying the shift points.

The calculation of the gearshift point based on the driver's style and driving situation is conducted on the basis of the "fuzzy logic" principle.



90010558.EPS

Fuzzy Logic

"Fuzzy logic" is defined as "*A form of logic used in some artificial-intelligence applications in which variables can have degrees of truthfulness or falsehood represented by a range of values between 1 (yes) and 0 (no).*" It forms the basis for programming designed to allow computers to mimic human intelligence.

When we make use of "fuzzy logic", we eliminate the classical hard operating states, and allow tolerance in assigning quantities.

Classical Division

The classical, rigid allocation of quantities in a computer **without** "fuzzy logic" results in only two choices: On or Yes (1) and Off or No (0). When provided with a fixed limit for comparison, the computer can distinguish only between hot and cold. Any measurement below the fixed limit is interpreted as cold, and measurements above are hot. This rigid classification does not allow the computer any tolerance in allocating quantities.

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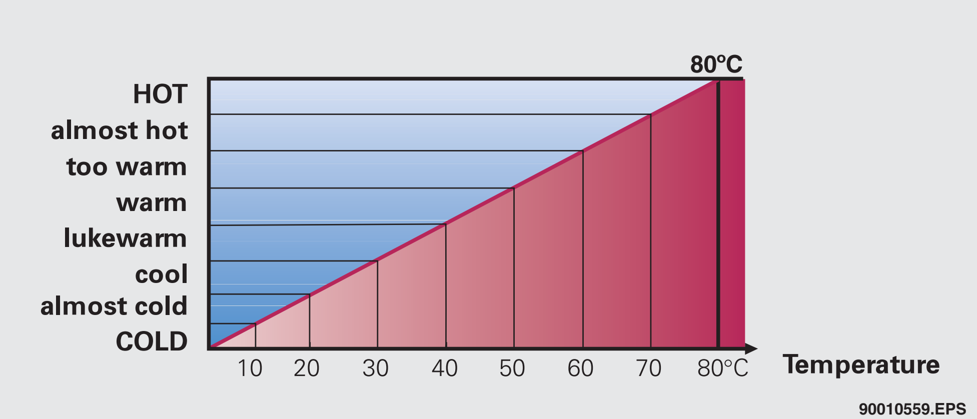
Protected
lkswagen AG.

Fuzzy Logic

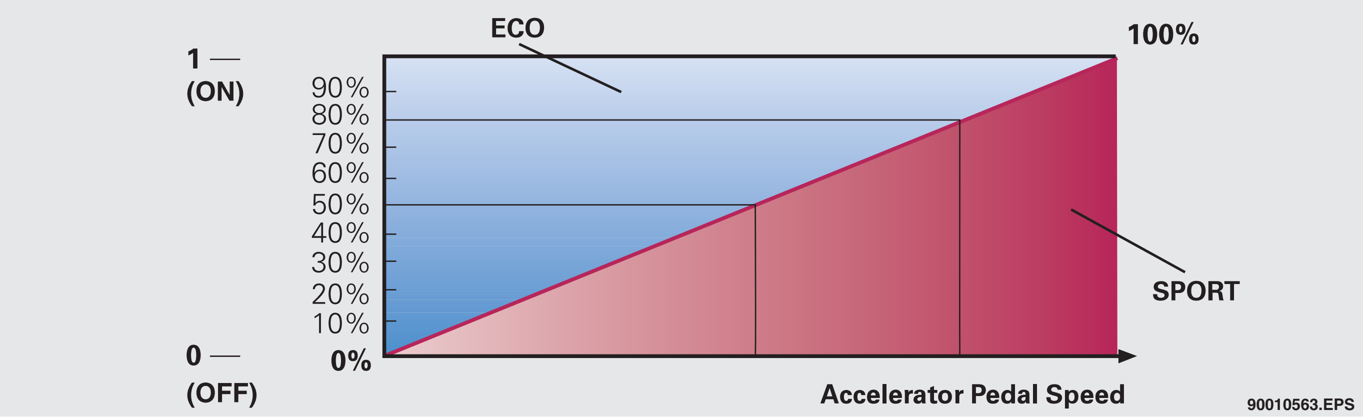
“Fuzzy logic” makes allowance for an intentional out-of-focus (fuzziness) which does not operate with two values, but instead with result quantities. What we then have is an infinite variety of intermediate values such as “almost cold”, “cool”, “lukewarm”, or “too warm”.

The upper limit of “hot” and the lower limit of “cold”, as well as all the intermediate levels, are assigned to precise temperatures.

Consequently, 90% of the blue area is assigned to “cold” at a temperature of 10°C and 10% of the red area is assigned to “hot”. The “fuzzy logic” recognizes “almost cold”.



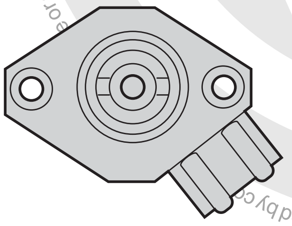
The speed at which the driver operates the accelerator pedal produces a sporty factor, which is determined with “fuzzy logic”. This sporty factor is used to determine a floating gearshift point between a shift point design oriented toward good fuel economy or performance. It is possible to have any number of shift points between the ECO and the SPORT shift characteristic, reacting much more responsively to the individual’s driving style.



Sensors

Sensors are components that relay the transmission fluid temperature, transmission input speed, transmission output speed, and many other signals to the TCM.

The TCM interprets this information and uses it to control the actuators. The TCM also uses this information to make the correct shifts at the correct time, and to tailor the shift points to complement the individual habits of each driver.



90010564.EPS

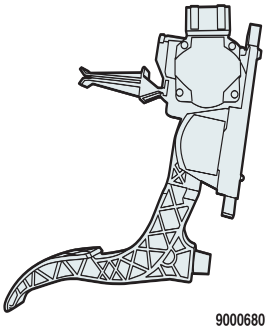
Throttle Position (TP) Sensors

The throttle valve position signal supplies information to the TCM regarding both the accelerator position (implied load), and the speed at which the accelerator pedal is operated.

TP Sensor G69

Vehicles using Motronic Engine Management 5.9, and earlier systems with a cable operated throttle, use TP Sensor G69 to sense throttle valve position. The signal goes to the ECM and is passed on to the TCM.

On some Phase 0 units, TP Sensor G69 contains two separate potentiometers, one each for the ECM and the TCM.



90006801.EPS

Accelerator Pedal Position Sensors

- TP Sensor G79
- Sender 2 for APP Sensor G185

Vehicles using Motronic Engine Management ME7 and Electronic Power Control (EPC) use APP Sensors G79 and G185, which are mounted in the accelerator pedal module. The ECM calculates engine torque and sends the information to the TCM through the Controller Area Network (CAN) data bus.

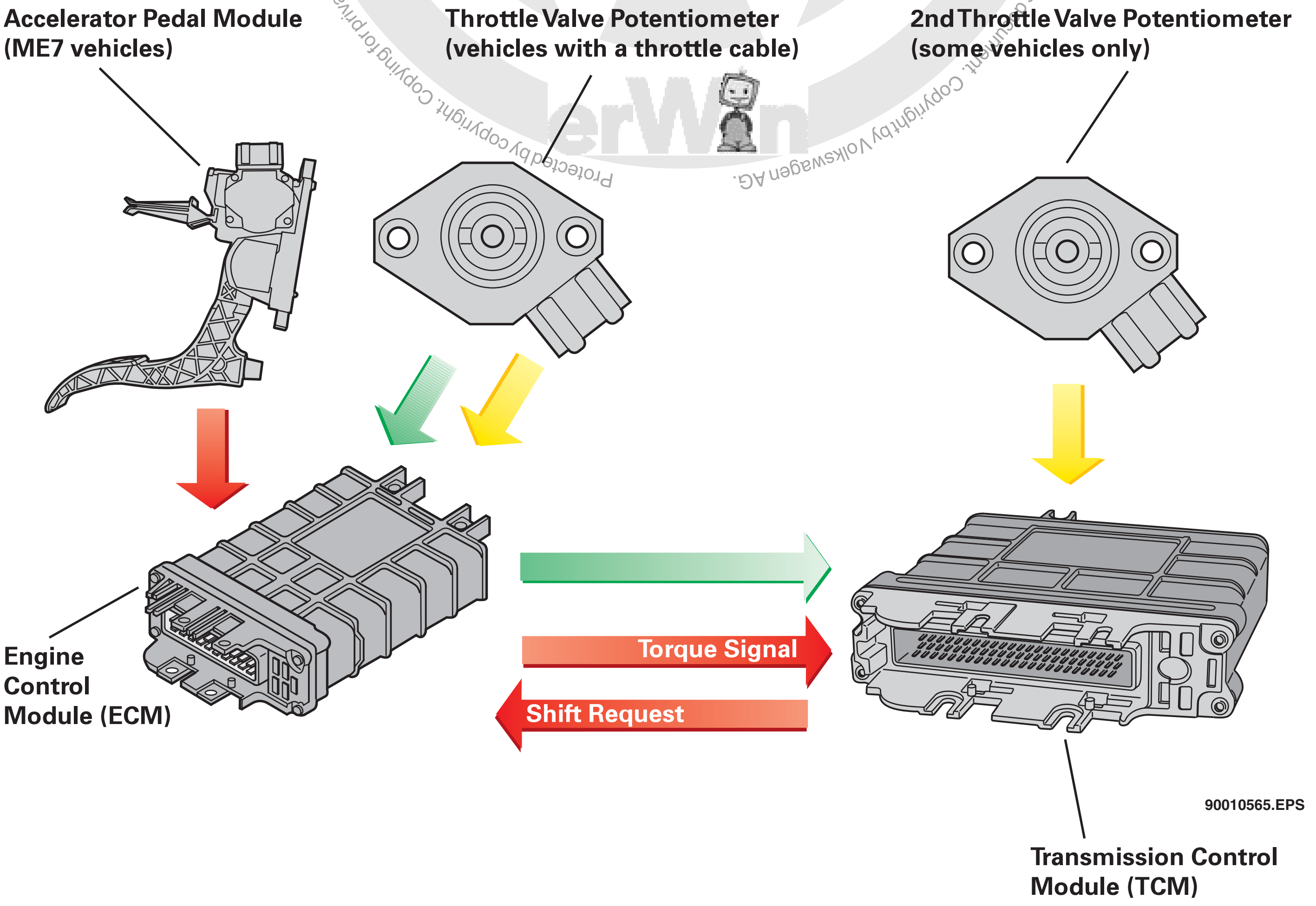
Use of Signal

In all versions, the signal is used to calculate the gearshift moment in-line with engine load and set the ATF pressure in-line with engine load and the gear selected.

In the Phase 2 and Phase 2 ETA units, the TCM determines the shift pressures required. The gearshift sequence is structured in such a way that the TCM first sends a signal to the ECM indicating that it wishes to execute a gearshift. The ECM then retards ignition timing, reducing engine torque and allowing the TCM to close the clutches at low pressure. This results in soft, jolt-free gearshifts.

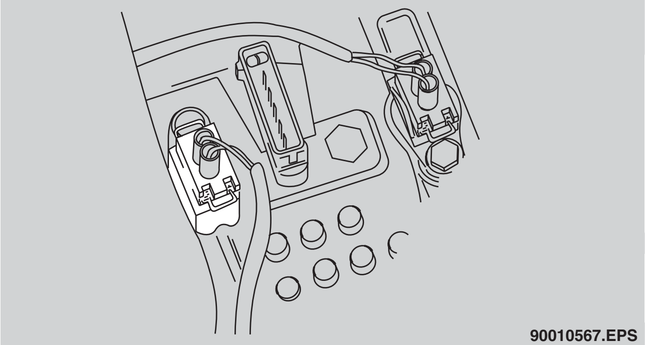
Effects of a Signal Failure

The control module assumes a moderate engine load for the gearshift points. This will result in harsher shifts, as the ATF pressure is set to full throttle pressure. The shift programs can no longer be performed by the control module.


Accelerator Pedal Module
(ME7 vehicles)
Throttle Valve Potentiometer
(vehicles with a throttle cable)
2nd Throttle Valve Potentiometer
(some vehicles only)
Engine
Control
Module (ECM)
Torque Signal
Shift Request
90010565.EPS
Transmission Control
Module (TCM)

Transmission Vehicle Speed Sensor (VSS) G38 (Phase 2 and Phase 2 ETA units only)

This inductive sensor is positioned in the transmission case. It detects the speed of the large sun wheel in the planetary gear.



The connector is white.

Use of Signal

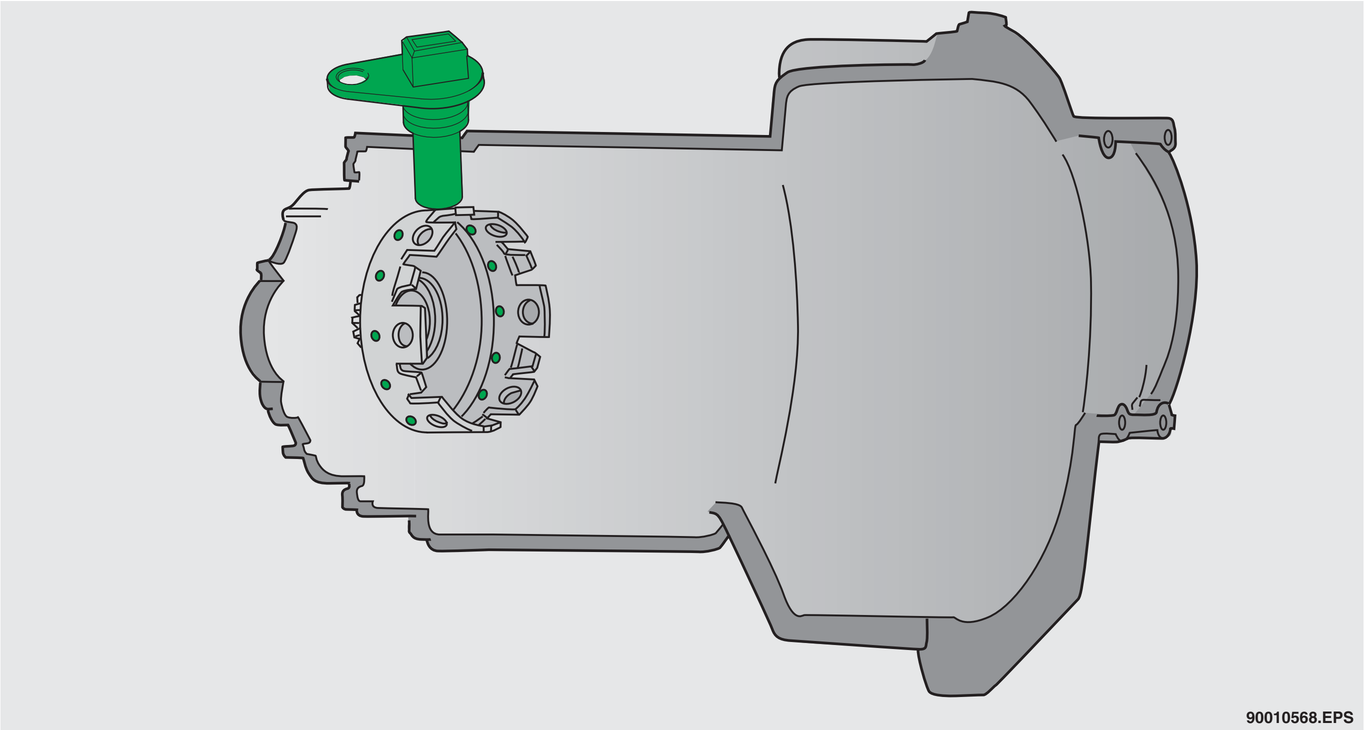
The speed of the large sun wheel enables the TCM to accurately recognize the moment at which the gearshift is performed.

The speed signal is used by the TCM to accurately calculate the following functions:

- A reduction in engine torque during the gearshift by retarding the ignition angle (timing)
- Controlling the speed of the gearshift (shift quality)

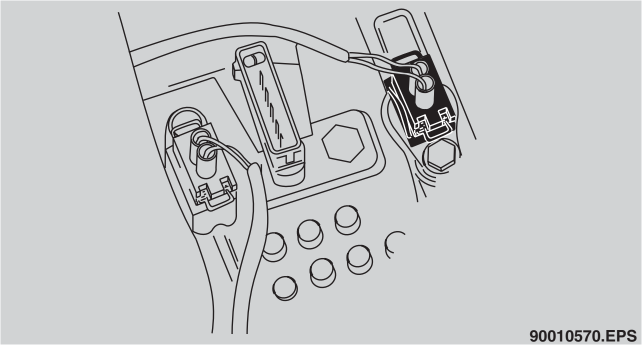
Effects of Signal Failure

The TCM moves into emergency running mode.



Vehicle Speed Sensor (VSS) G68

This inductive sensor is mounted in the transmission case. It calculates the output speed of the planetary gearset by measuring the speed of a pulse rotor mounted on the input gear to the final drive.



The connector is black.

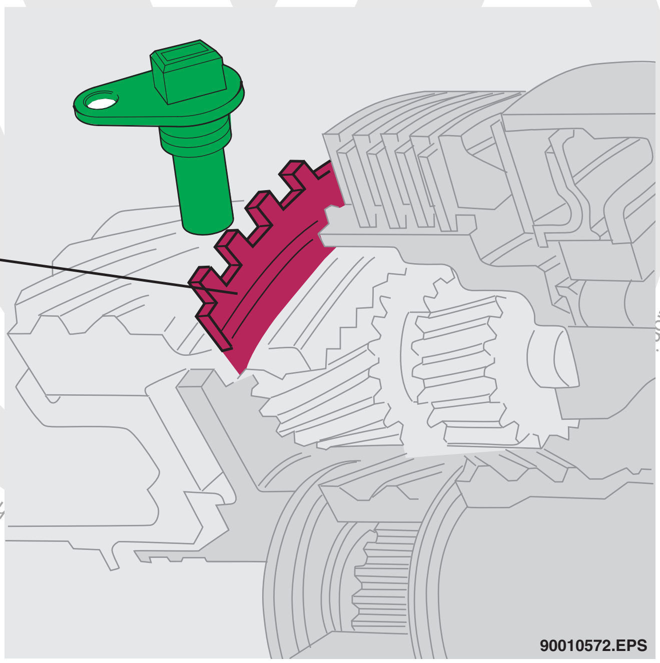
Use of Signal

Information regarding vehicle speed is required for:

- The decision as to which gear should be engaged
- Cruise control system
- Torque converter slip control
- Shift quality

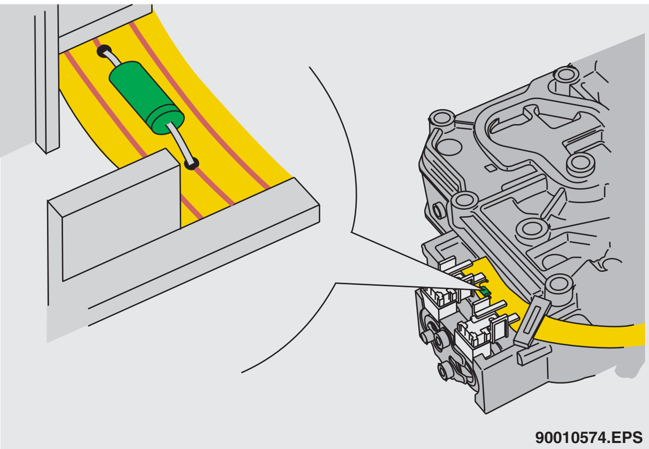
Effects of Signal Failure

- The control module uses the engine speed as a substitute signal
- The TCC is no longer closed
- Shift quality is no longer measured



Transmission Fluid Temperature Sender G93

This sensor, mounted on the printed conductor at the valve body, measures the temperature of the ATF.



90010574.EPS

Use of Signal

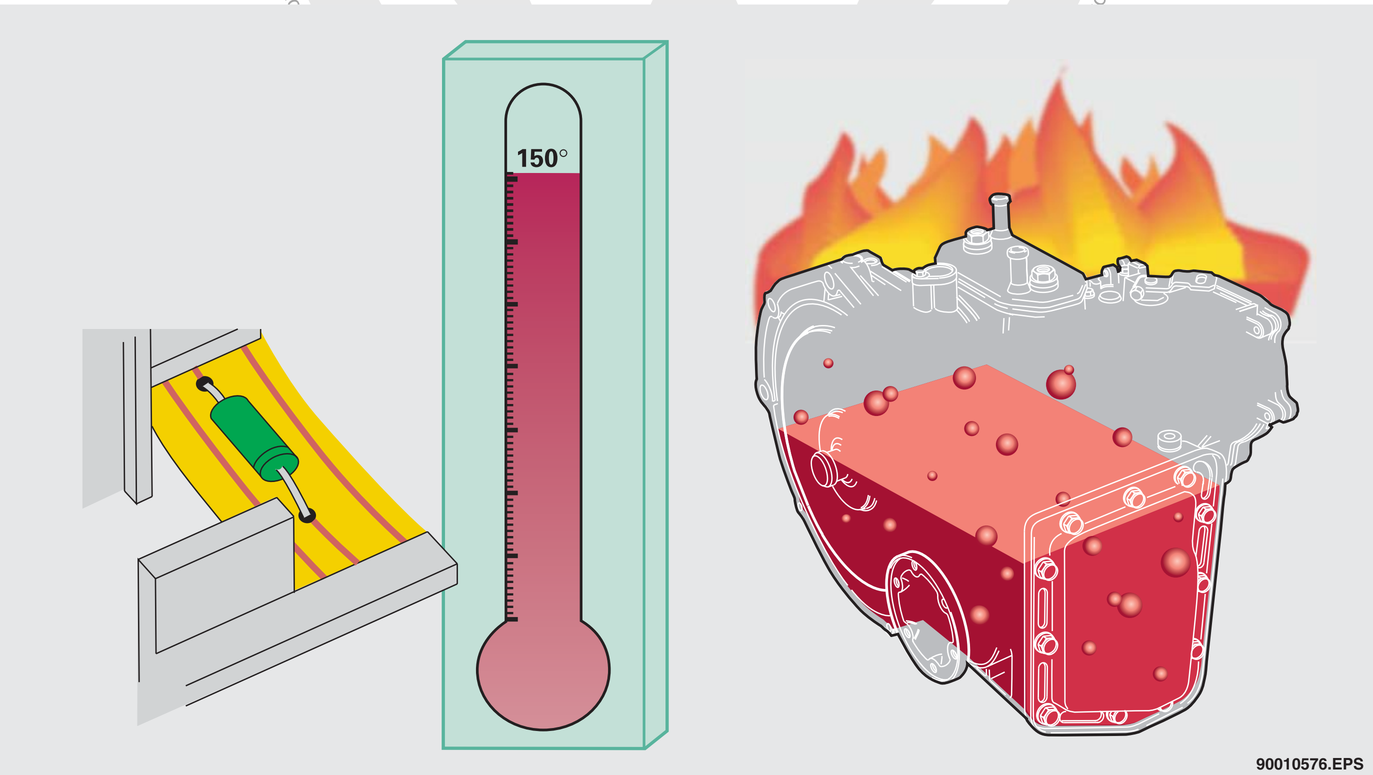
The ATF Temperature Sender G93 is a Negative Temperature Coefficient (NTC) resistor. Its resistance drops as the fluid temperature rises.

If the ATF temperature reaches the limit of 148°C, the TCC is engaged. The stress on the torque converter is reduced, and the ATF cools down.

If engaging the TCC doesn't cool the ATF to an acceptable level, the TCM commands a downshift to further reduce stress within the transmission.

Effects of Signal Failure

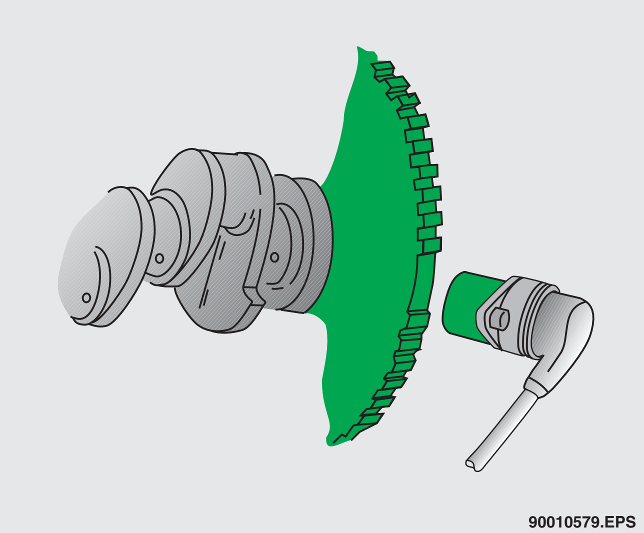
- No substitute functions exist



90010576.EPS

Engine Speed Sensor G28

The TCM uses the engine speed signal from the vehicle's ECM.



Use of Signal

The TCM compares the engine speed and the vehicle speed. The TCM then determines the amount of slip of the TCC based on the difference of the two signals. If the difference is significant (too much slip), the TCM increases the contact pressure of the TCC and thus reduces the slip.

The TCM also uses the signal of the engine speed sensor as a substitute parameter for the signal of the VSS.

Effects of Signal Failure

- The control module moves into emergency running mode.

Kick Down Switch F8

The kick down switch detects the accelerator being depressed beyond the full throttle point.

On the TDI engine, the switch is incorporated in the APP Sensor.

On vehicles that are not equipped with ME7 engine control, the kick down switch is integrated into the accelerator cable. The switch is located in the engine compartment in front of the passenger compartment spray guard.

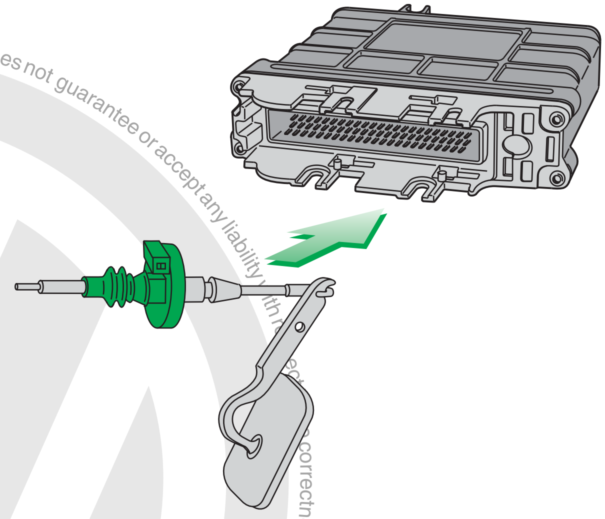
Use of Signal

When the switch is operated, the transmission shifts down immediately into the next lower gear (e.g. from 4th to 3rd gear). The TCM takes account of the engine speed. Upshifts will occur at higher engine speeds.

If a high power output is required from the engine in the kick down mode, the air conditioning system is switched off for up to 8 seconds.

Effects of Signal Failure

- The kick down shift point occurs when the accelerator pedal is depressed 95%.



90010581.EPS

On vehicles with a throttle cable, make sure the cable is adjusted correctly. Incorrect adjustment can cause drivability concerns. Check current service information for the correct adjustment procedure.

Vehicles with ME7 do not have a throttle cable. The ME7 kick down strategy is explained on the next page.

Motronic Kick Down Strategy

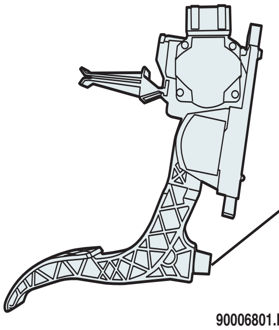
Vehicles with ME7 engine control do not have a throttle cable or kick down switch. These vehicles use an accelerator pedal module to determine the position of the accelerator pedal.

The accelerator pedal module consists of two independent potentiometers: G79 and G185. If one sensor fails, the other acts as a substitute.

Automatic transmission vehicles have a pressure element in place of the accelerator pedal stop. This pressure element generates a mechanical pressure point which gives the driver a kick down feeling.

When the driver pushes the throttle pedal to this point, the internal components of the accelerator pedal module will exceed the full-load voltage normally sent to the ECM. The ECM interprets this excessive voltage level as a kick down action and will transfer this information to the TCM.

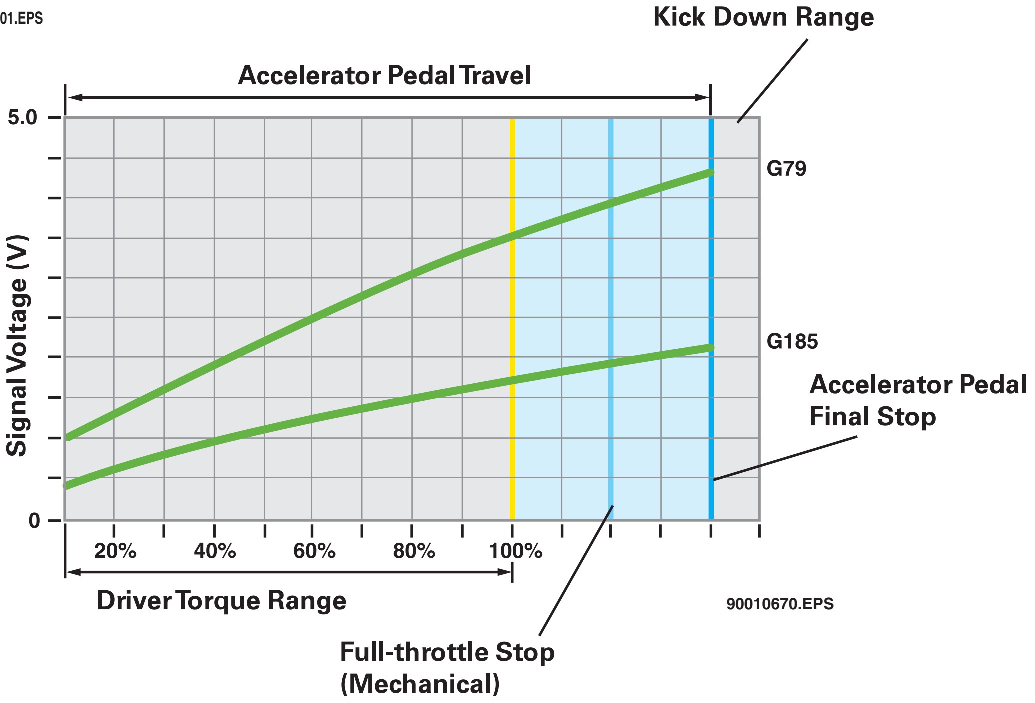
The kick down switching point can only be tested using diagnostic testers.



Pressure Element
(to convey kick down feel)

90006801.EPS

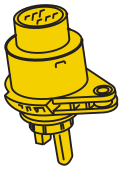
If the accelerator pedal module or ECM is changed, the throttle valve adaptation function must be performed using the VAS 5051/5052.



90010670.EPS

Multi-function Transmission Range (TR) Switch F125

The multi-function switch is located in the transmission housing and is operated by the cable of the selector lever.



90010586.EPS

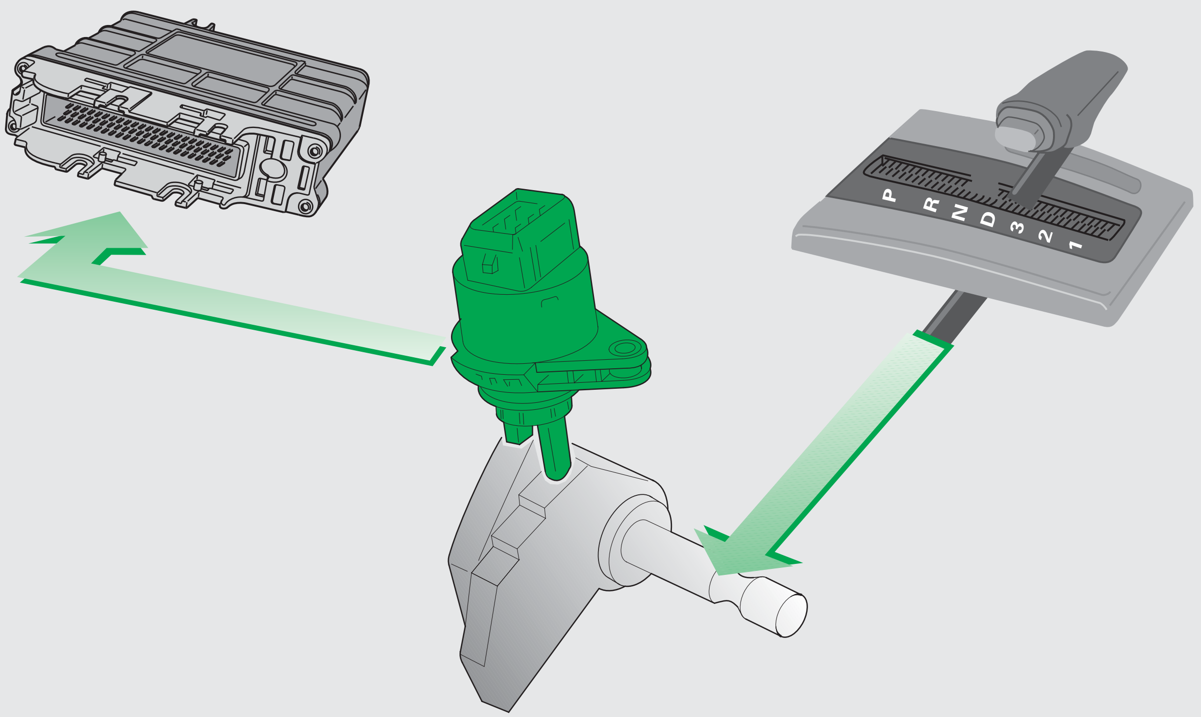
Use of Signal

Depending on the gear selected and the corresponding signal from the multi-function switch, the TCM initiates the following functions:

- Switches on the reversing lights
- Locks-out the starter if a position other than Park or Neutral is selected
- Provides information to block cruise control operation in Park, Neutral, Reverse, and at speeds below 24 mph

Effects of Signal Failure

- The TCM moves into emergency running mode
- The TCM assumes gearshift selector lever position “D”



90010587.EPS

Brake Light Switch F

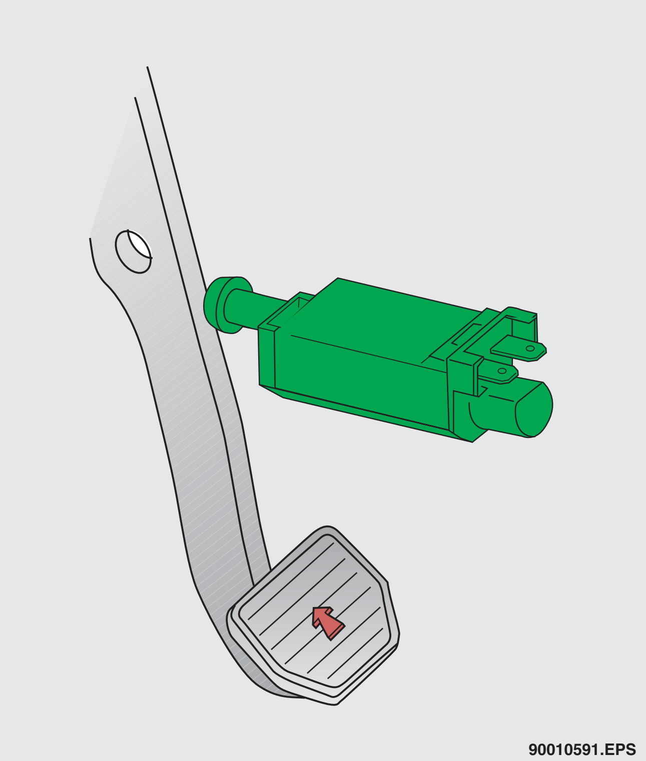
The brake light switch is installed at the pedal bracket. The TCM is supplied with the information "brake operated", through this switch.

Use of Signal

- The information of the brake light switch is required for the selector lever lock function
- The gearshift selector lever cannot be moved out of the Park or Neutral position when the vehicle is stationary, unless the brake pedal has been operated

Effects of Signal Failure

- If the contact is interrupted, the gearshift selector lever lock function is no longer performed
- The TCM moves into emergency running mode
  - The TCM assumes gearshift selector lever position "D"



Cold Neutral Control (CNC)

The 2.0L 2002 and up and the 2003 Super Ultra Low Emission Vehicles (SULEV) with the four-speed automatic transmission are equipped with CNC. This control serves to lower emissions when the engine is first started by keeping the transmission in Neutral until the catalytic converter warms-up a little.

The function for CNC in Drive (and Reverse for SULEV) is as follows:

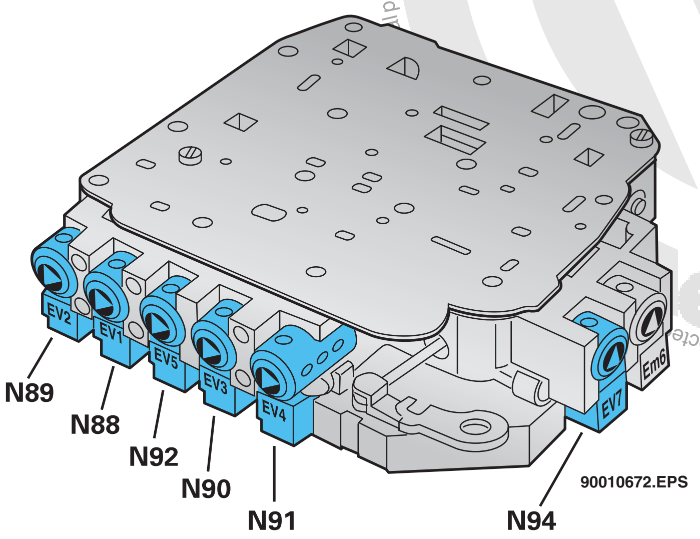
- Ignition "ON"
- ATF temperature below 40°C
- Brake pedal pressed (brake light switch activated)
- Throttle pedal = 0
- Speed = 0
- Shift lever in "D" for the first time after ignition "ON"
- CNC is activated

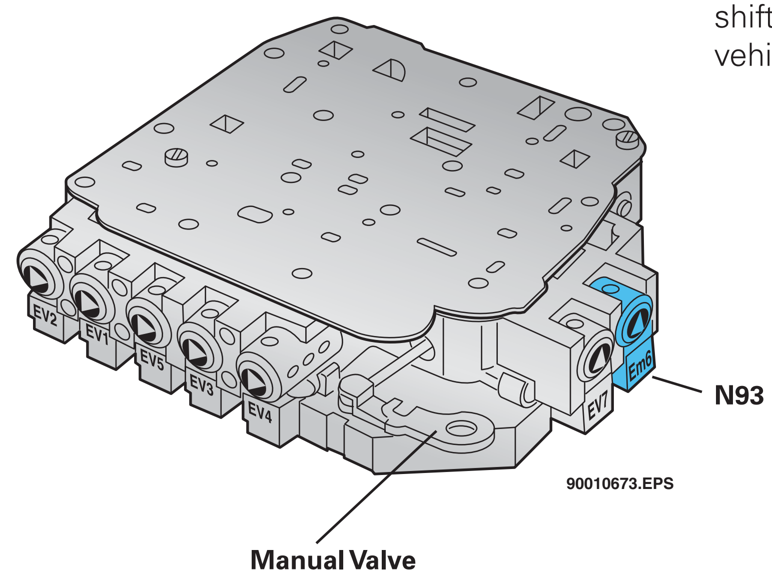
If one of the above conditions does not exist, CNC will not be active.

The CNC is activated only once after ignition "ON" as long as the ATF temperature is below 40°C.

The CNC is necessary only as long as the catalyst is cold; that is why CNC is needed only at the very beginning.

The actuators are valve body solenoids, pressure control valves, shift lock solenoids, and many other components. They do the work and move when commanded.


EV2
EV1
EV5
EV3
EV4
EV7
Em6
N89
N88
N92
N90
N91
N94
90010672.EPS


EV2
EV1
EV5
EV3
EV4
EV7
Em6
N93
90010673.EPS
Manual Valve

Solenoid Valves N88 to N94

The solenoid valves for all phases are located in the valve body, and are operated by the TCM. Two different types of solenoid valves are used:

- On/Off solenoid valves open or close an ATF port
- Modulation solenoid valves make it possible to set the level of the clutch pressure required
  - – The TCM specifies the amperage
  - – A low amperage means high pressure

Solenoid valves are assigned different functions based on the transmission phase.

Phase 0 and Phase 1

Solenoid valves N88, N89, N90, N91, N92 and N94 are On/Off valves.

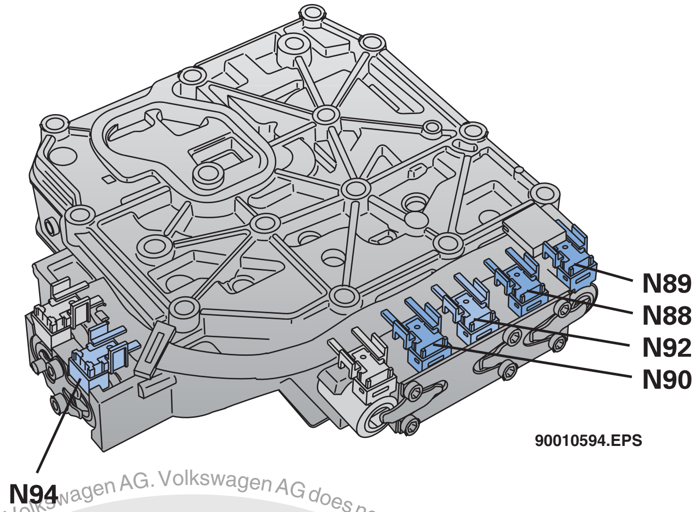
- The gears specified by the TCM are engaged by valves N88, N89, N90, and N91
- The gearshift transition (smoothness) is influenced by valves N92 and N94

Solenoid valve N93 is a modulation valve. The main pressure is controlled by the electrical current in the valve, depending on the gear, the shift program ECO/SPORT, the load, and the vehicle speed.

Phase 2 and Phase 2 ETA

Solenoid valves N88, N89, N90, N92, and N94 are On/Off valves.

- The gears specified by the TCM are engaged by valves N88, N89, and N90
- The smoothness of the gearshift is influenced by valves N92 and N94
  - In Phase 2, N94 changes position of the diverter valve for the B2 brake and K3 clutch
  - In Phase 2 ETA, N94 changes position of the K1 diverter valve to relieve oil pressure rapidly in the K1 during 3rd to 4th gear shift



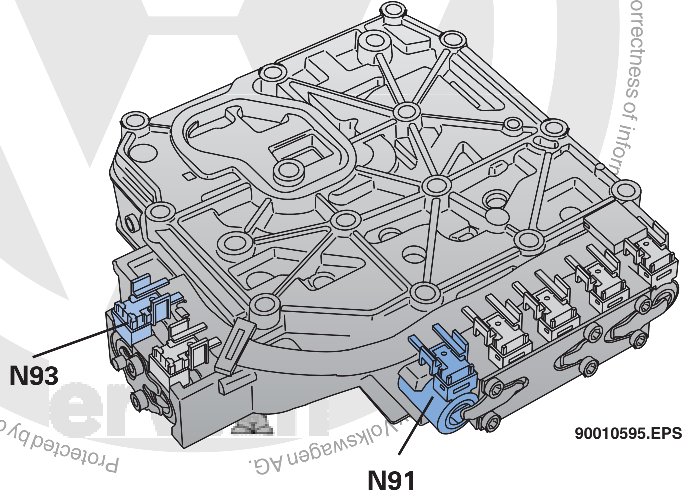
Solenoid valves N91 and N93 are modulation valves.

- Solenoid valve N91 controls the clutch pressure for the TCC
- Solenoid valve N93 controls the pressure of the multi-plate clutches and multi-plate brakes

Effects of Signal Failure

If a solenoid valve fails, the TCM moves into emergency running mode.

The printed conductor can be replaced separately. Please use special tool 3373 for this operation.



Phase 0 Clutch and Brake Apply Chart

Gear	B1	B2	K1	K2	K3	F
Man Low	●		●			
Reverse	●			●		
Dr. 1H			●			●
Dr. 2H		●	●			
Dr. 3H			●	●		
Dr. 3LT1			●		●	
Dr. 3M			●	●	●	
Dr. 3LT2				●	●	
Dr. 4M		●			●	

Phase 1 Clutch and Brake Apply Chart

Gear	B1	B2	K1	K2	K3	F
Man Low	●		●			
Reverse	●			●		
Dr. 1H			●			●
Dr. 2H		●	●			
Dr. 3H			●	●		
Dr. 4M		●			●	

Key

● = **Clutch, Brake, or Freewheel Applied**
H = **Hydraulic***
M = **Mechanical***
LT1 = **Load Splitting****
LT2 = **Load Splitting****

Clutch and Brake Apply Charts

These charts show which clutches and brakes are applied for each of the gear ranges.

Problems in one gear can be diagnosed by having an understanding of which clutches and brakes are in use at that time. Also, comparing when other gears are using the same clutches, and using the solenoid charts on the next pages, can help pinpoint the source of a concern.

If there is a clutch problem, the ATF is likely to be burned, especially if the transmission feels like it is trying to engage.

If the transmission does not respond to gearshift commands at all, the problem may be in a solenoid, valve, or valve body – not a clutch.

Phase 2 and Phase 2 ETA Clutch and Brake Apply Chart

Gear	B1	B2	K1	K2	K3	F	LC
Man Low	●		●				
Reverse	●			●			
Dr. 1H			●			●	
Dr. 1M			●			●	●
Dr. 2H		●	●				
Dr. 2M		●	●				●
Dr. 3H			●		●		
Dr. 3M			●		●		●
Dr. 4H		●			●		
Dr. 4M		●			●		●

* Hydraulic and Mechanical refer to the state of the K3 Clutch (Phase 0 and Phase 1) or the TCC (Phase 2 and Phase 2 ETA).

** LT1 and LT2 are used in the Phase 0 transmissions to help smooth the shift into mechanical gear ranges.

Part	Name	Purpose	Gear Range			Controls
			Phase 0	**Phase 1**	**Phase 2/ETA**	
B1	Reverse Brake	Holds planet carrier	R, Man Low	R, Man Low	R, Man Low	Manual Valve
B2	2nd/4th Gear Brake	Holds large sun gear	2, 4	2, 4	2, 4	EV2-N89 applies when energized
K1	1st to 3rd Gear Clutch	Drives small sun gear	1, 2, 3	1, 2, 3	1, 2, 3	Manual valve EV1-N88 blocks apply when energized in 4th
K2	Reverse Clutch	Drives large sun gear	R, 3H, 3M	R, 3M	R	Manual valve: Phase 0 and 1 only EV4-N91 blocks apply in 1, 2, 4 when energized
K3	3rd/4th Clutch	Drives planet carrier	3M, 4M	4M	3, 4	Phase 0/1, EV3-N90 applies when energized. Phase 2/ETA manual valve EV3-N90 blocks apply when energized in P, R, N, 1, 2
LC	TCC	Holds turbine to torque converter housing	N/A	N/A	Possible in all forward gears	Phase 2/ETA only. EV4-N91 apply (pulse width modulated)
F	One Way Clutch	Prevents planet carrier from turning backwards	Drive 1 – all phases			

Solenoid Apply Charts

The solenoid application charts show which solenoids are energized for each gear.

If a solenoid is inoperative electrically, a code will set and the system will go into emergency running mode. If a solenoid fails mechanically, the computer may not set a code and shifting problems will occur.

By analyzing the information provided by the solenoid and clutch application charts, you can focus your road test and improve your diagnostic accuracy.

Phase 0 Solenoid Chart

Gear Selection	Gear Range	Solenoid Pattern						
		1	2	3	4	5	6	7
Park	**0**	●			●		●	
Reverse	**R**						●	
Neutral	**0**	●			●		●	
Dr. 1	**1**				●		●	
Dr. 2	**2**		●		●		●	
Dr. 3	**3**						●	
Dr. 4	**4M**	●	●	●	●		●	

Phase 1 Solenoid Chart

Gear Selection	Gear Range	Solenoid Pattern						
		1	2	3	4	5	6	7
Park	**0**	●			●		●	
Reverse	**R**						●	
Neutral	**0**	●			●		●	
Dr. 1H	**1**				●		●	
Dr. 2H	**2**		●		●		●	
Dr. 3H	**3H**						●	
Dr. 3M	**3M**			●			●	
Dr. 4M	**4M**	●	●	●	●		●	

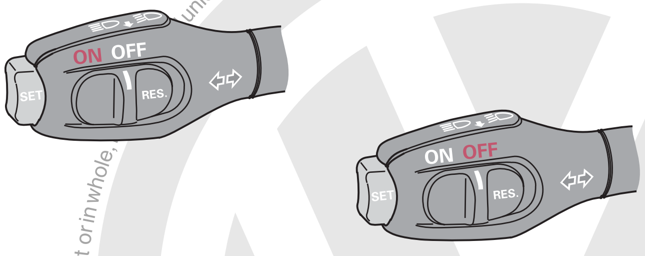
Phase 2 Solenoid Chart

Gear Selection	Gear Range	Solenoid Pattern						
		1	2	3	4	5	6	7
Park	**0**	●		●			●	
Reverse	**R**			●			●	
Neutral	**0**	●		●			●	
Dr. 1H	**1H**			●			●	
Dr. 1M	**1M**			●	●		●	
Dr. 2H	**2H**		●	●			●	
Dr. 2M	**2M**		●	●	●		●	
Dr. 3H	**3H**						●	●
Dr. 3M	**3M**				●		●	●
Dr. 4H	**4H**	●	●				●	●
Dr. 4M	**4M**	●	●		●		●	●

Phase 2 ETA Solenoid Chart

Gear Selection	Gear Range	Solenoid Pattern						
		1	2	3	4	5	6	7
Park	**0**	●		●			●	
Reverse	**R**			●			●	
Neutral	**0**	●		●			●	
Dr. 1H	**1H**			●			●	
Dr. 1M	**1M**			●	●		●	
Dr. 2H	**2H**		●	●			●	
Dr. 2M	**2M**		●	●	●		●	
Dr. 3H	**3H**						●	
Dr. 3M	**3M**				●		●	
Dr. 4H	**4H**	●	●				●	●
Dr. 4M	**4M**	●	●		●		●	●

Solenoid	Purpose	Gear Range			
		Phase 0	Phase 1	Phase 2	Phase 2 ETA
EV1-N88	Blocks pressure to K1	P, R, 4	P, R, 4	P, R, 4	P, R, 4
EV2-N89	Applies B2	2, 4	2, 4	2, 4	2, 4
EV3-N90	Phases 0/1 applies K3 Phases 2/ETA blocks K3	3M, 4M	4M	P, R, N, 1, 2	P, R, N, 1, 2
EV4-N91	Phases 0/1 blocks K2 (on/off) Phases 2/ETA applies TCC (pulse width modulated)	P, R, N, 1, 2, 4	P, R, N, 1, 2, 4	P, R, N, 1, 2, 4	P, R, N, 1, 2, 4
EV5-N92	On/Off shift comfort valve	All phases ON in 1st when stopped Flashes between all gear shifts except Phases 0/1 3-4 up-shift			
EV6-N93	Electronic pressure control (pulse width modulated)	Regulates main line pressure in valve body by duty cycle signal, based on shift program, throttle position (load), and vehicle speed			
EV7-N94	On/Off shift comfort valve * See Note	Flashes between 3-4 up-shift and down-shift		Flashes on 2-3 up-shift and down-shift; On in 3rd and 4th	On in 4th
* Note:	In Phase 2, N94 changes position of the diverter valve for the B2 brake and K3 clutch. In Phase 2 ETA, N94 changes postion of K1 diverter valve to relieve oil pressure rapidly in the K1 during 3rd to 4th gear shift.				



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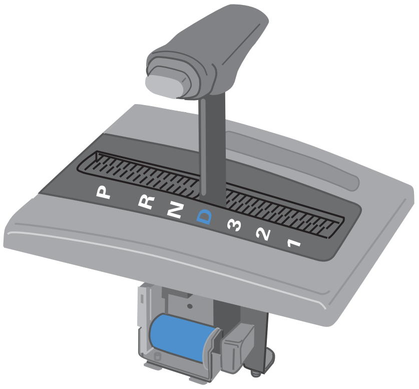
Cruise Control System

The power for the cruise control system is supplied by the TCM.

The TCM will make power available to the cruise control system when the system is switched on and the vehicle speed is greater than 30 km/h (about 19 mph). The cruise control system operates in selector lever positions D, 3, and 2.

The TCM interrupts the power supply if the selector lever is shifted into P, R, N, or 1.



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Shift Lock Solenoid N110

The gearshift selector lever lock is located on the selector lever.

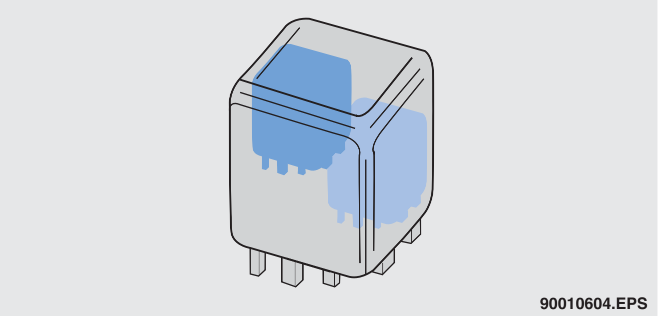
The solenoid is switched on with the ignition and prevents a drive position being engaged. The lock is overridden by derepressing the brake pedal. The selector lever then can be moved into a Drive position.

Park/Neutral Position (PNP) Relay J226

This is a combination relay and is integrated in the electrical center. This relay:

- Prevents the engine from starting when a Drive position is engaged
- Supplies power to the reversing lights when Reverse gear is selected

The relay is activated by a signal from the multi-function switch F125.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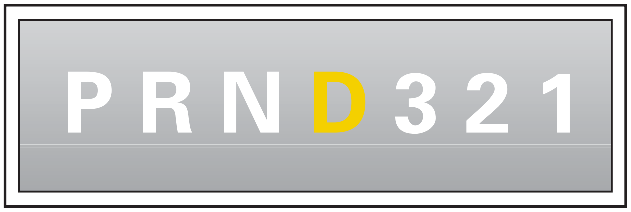
Selector Lever Display

A selector lever display is integrated in the dash panel insert, indicating the position of the selector lever at that moment.

If a fault is stored in the fault memory that is not covered by a substitute function, all the range indicator lights in the selector lever display will be illuminated.



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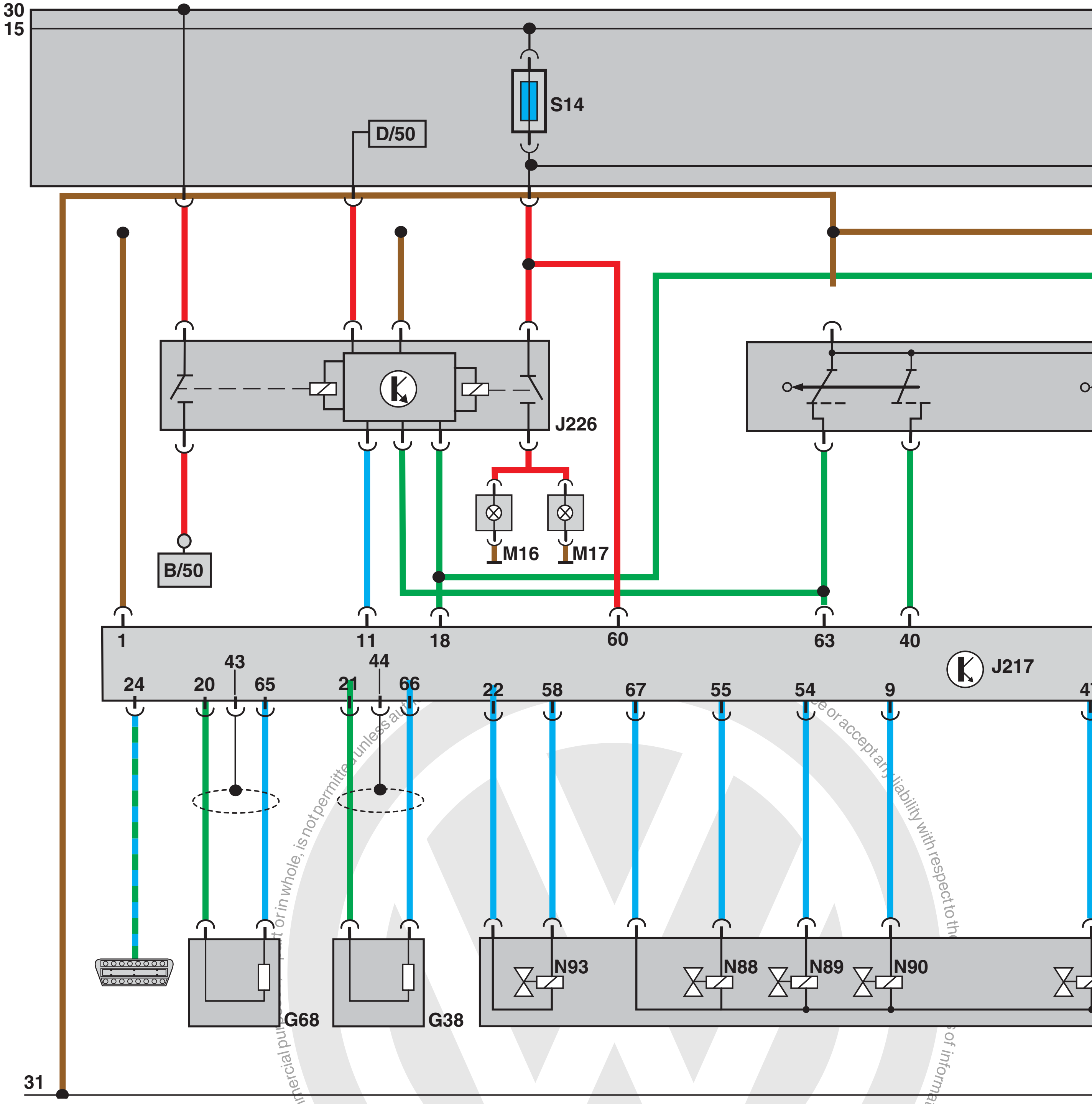
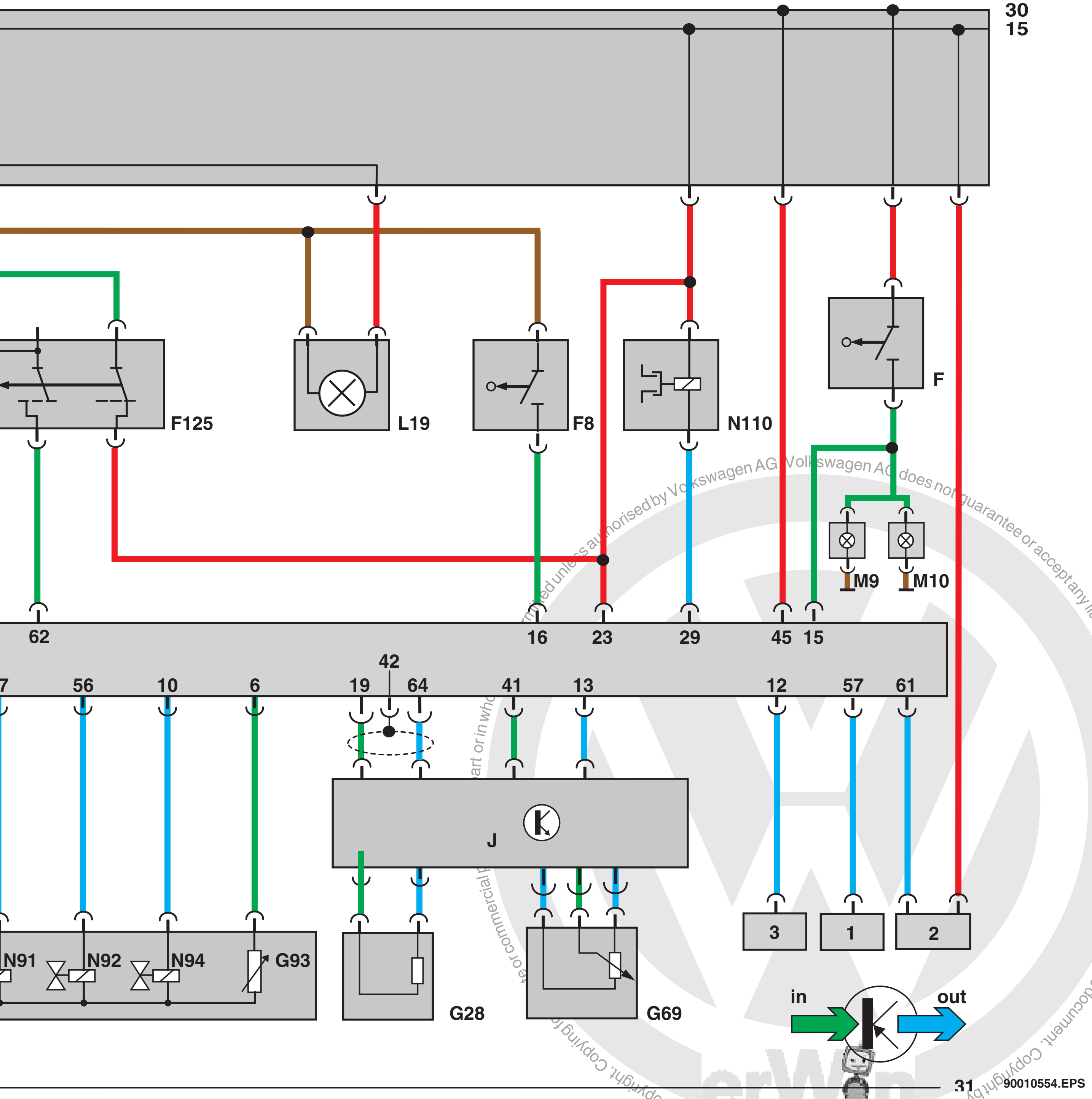
Function Diagram (example)


30
15
S14
D/50
J226
B/50
M16
M17
1
11
18
60
63
40
J217
43
44
24
20
65
21
66
22
58
67
55
54
9
N93
N88
N89
N90
G68
G38
31

Components

B/50	Starter (terminal 50)
D/50	Ignition/Starter Switch (terminal 50)
F	Brake Light Switch
F8	Kick Down Switch
F125	Multi-function Transmission Range (TR) Switch
G28	Engine Speed Sensor
G38	Transmission Vehicle Speed Sensor (VSS)
G68	Vehicle Speed Sensor (VSS)
G69	Throttle Position (TP) Sensor
G93	Transmission Fluid Temperature Sensor
J226	Park/Neutral Position (PNP) Relay
J	Engine Control Module (ECM)
J217	Transmission Control Module (TCM)
L19	Automatic Transmission Console Light
M16-17	Left and Right Back-up Lights
M9-10	Left and Right Brake Lights


30
15
F125
L19
F8
N110
F
M9
M10
62
16
23
29
45
15
7
56
10
6
42
19
64
41
13
12
57
61
J
N91
N92
N94
G93
G28
G69
3
1
2
in
out
31
90010554.EPS

N88	Solenoid Valve 1
N89	Solenoid Valve 2
N90	Solenoid Valve 3
N91	Solenoid Valve 4
N92	Solenoid Valve 5
N93	Solenoid Valve 6
N94	Solenoid Valve 7
N110	Shift Lock Solenoid
S14	Fuse

Additional Signals

1 Selector Lever Display
2 Cruise Control System
3 Air Conditioning

Color Codes

🟩 Input Signal
🟦 Output Signal
🟥 Positive
🟫 Ground

On-Board Diagnosis

The on-board diagnosis function monitors the signals of the sensors, the **electrical** (not **mechanical**) operation of the actuators, and performs a self-test of the TCM.

If a fault occurs, substitute functions are utilized and fault descriptions are stored in the non-volatile memory of the TCM. The faults are stored in memory even if the battery and TCM are disconnected.

When faults are stored, the TCM distinguishes between static and sporadic faults. If a fault occurs only once within several driving cycles, it is stored as a sporadic fault.

Sporadic malfunctions are stored in the memory and are displayed as "sporadic malfunctions" when retrieved by the VAS 5051 scan tool. "Sporadic" appears on the display in such cases. If the printer is switched on, sporadic malfunctions are printed out after the malfunction is addressed.

If the fault is no longer recognized over a distance of about 1000 km (625 miles) or 20 hours, it is automatically erased from memory. If the fault continues to exist within the stored drive cycles, it is stored as a static fault.

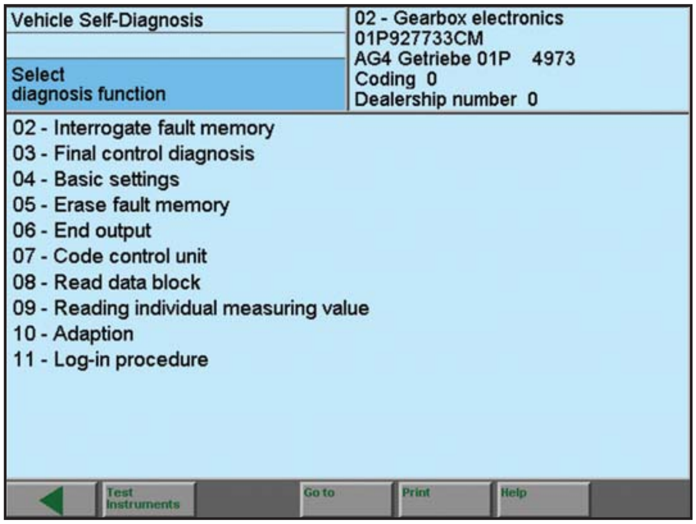
Inoperative CAN-Bus signals will be detected by the control module on vehicles equipped with CAN-Bus. Faulty CAN-Bus wiring e.g. open circuits, can be directly detected. Conclusions cannot be drawn as to where the CAN-Bus wiring is faulty until all control module DTC memories have been interrogated.

VAS 5051

Vehicle diagnostic-, measuring- and information system

Version -USA/CDN- / V03.20 02/09/2002

Vehicle Self-Diagnosis
OBD
Test Instruments
Guided Fault Finding
Applications
Administration
Print
Help



Vehicle Self-Diagnosis

Select diagnosis function

02 - Gearbox electronics
01P927733CM
AG4 Getriebe 01P 4973
Coding 0
Dealership number 0

02 - Interrogate fault memory
03 - Final control diagnosis
04 - Basic settings
05 - Erase fault memory
06 - End output
07 - Code control unit
08 - Read data block
09 - Reading individual measuring value
10 - Adaption
11 - Log-in procedure

VAS 5051/5052

The following functions are available by selecting **02 Gearbox Electronics:**

02 Interrogating fault memory

04 Starting basic setting

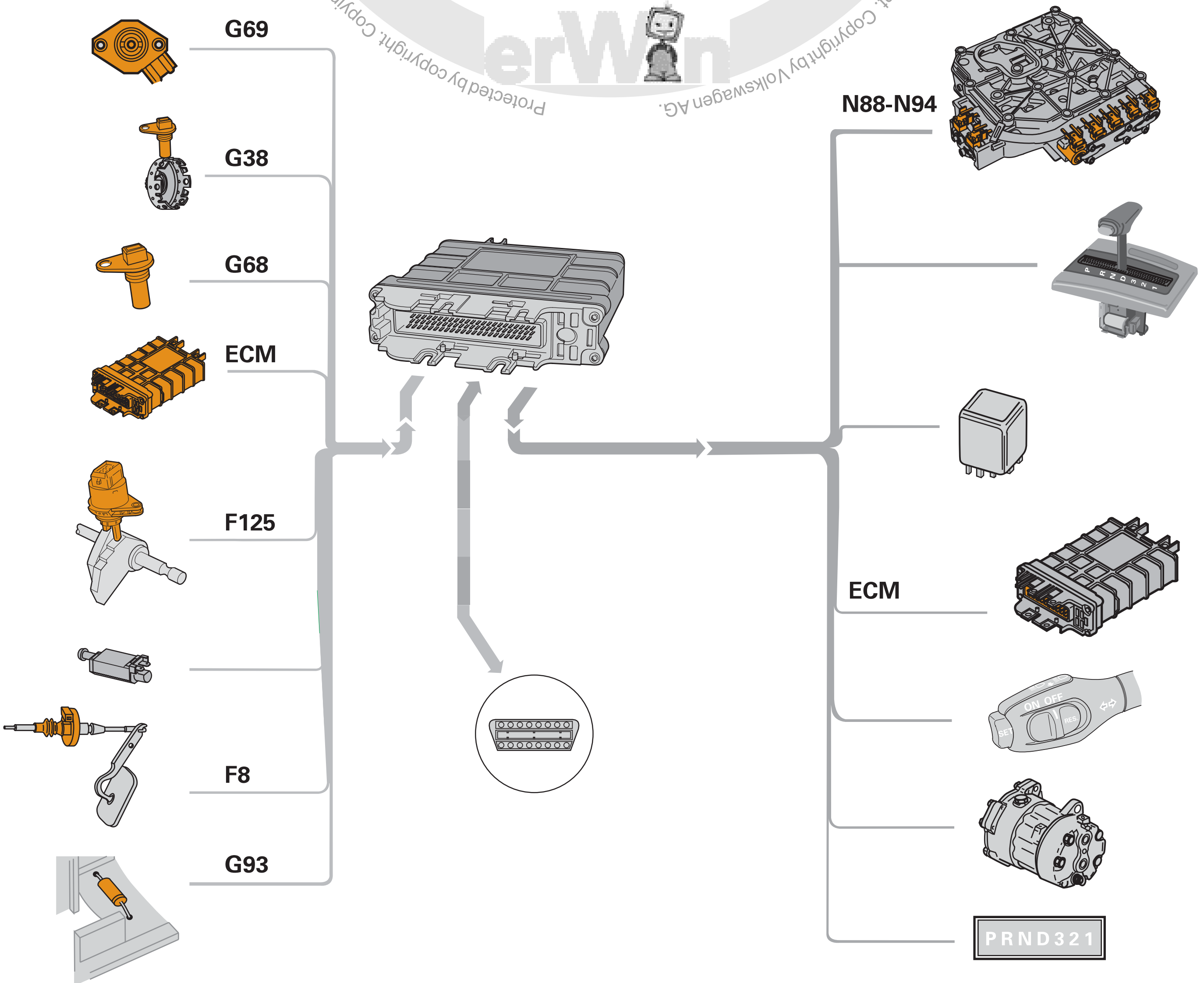
05 Erasing fault memory

06 Ending output

08 Reading measured value block

Function 02, Interrogating Fault Memory

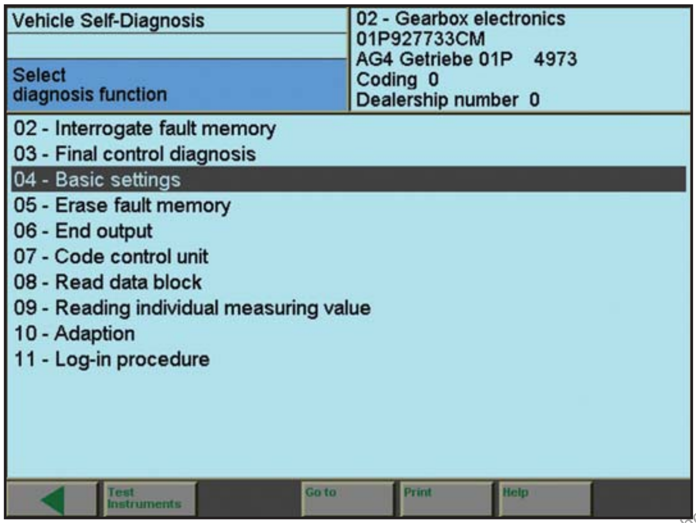
The sensor/actuators in color are monitored by the TCM.


G69
G38
G68
ECM
F125
F8
G93
N88-N94
ECM
ON OFF
RES
SET
PRND321

90010609.EPS

Function 04, Basic Settings Display Group 0

After performing certain repairs to the transmission or to the engine, it is necessary to erase the adaptive-shifting values. An example would be after replacing the throttle valve control module, transmission hardware, software, or TCM.

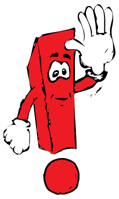


Vehicle Self-Diagnosis

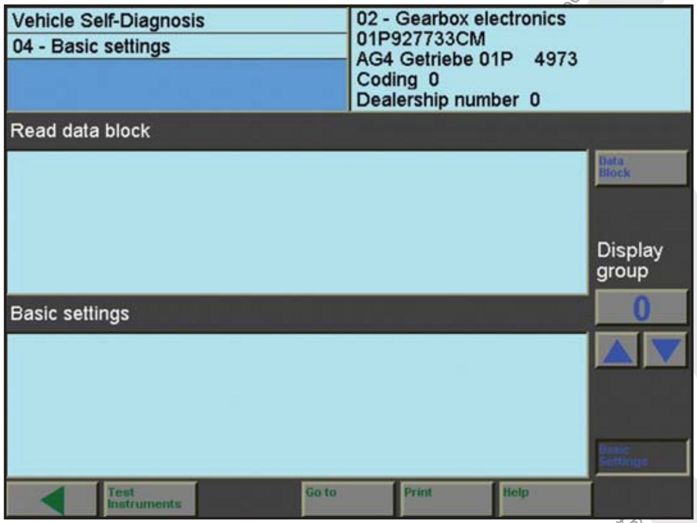
Select diagnosis function

02 - Gearbox electronics
01P927733CM
AG4 Getriebe 01P 4973
Coding 0
Dealership number 0

02 - Interrogate fault memory
03 - Final control diagnosis
04 - Basic settings
05 - Erase fault memory
06 - End output
07 - Code control unit
08 - Read data block
09 - Reading individual measuring value
10 - Adaption
11 - Log-in procedure
Test Instruments
Go to
Print
Help



Always refer to current service information for the exact procedure of when and how to initiate the Basic Settings.



Vehicle Self-Diagnosis

04 - Basic settings

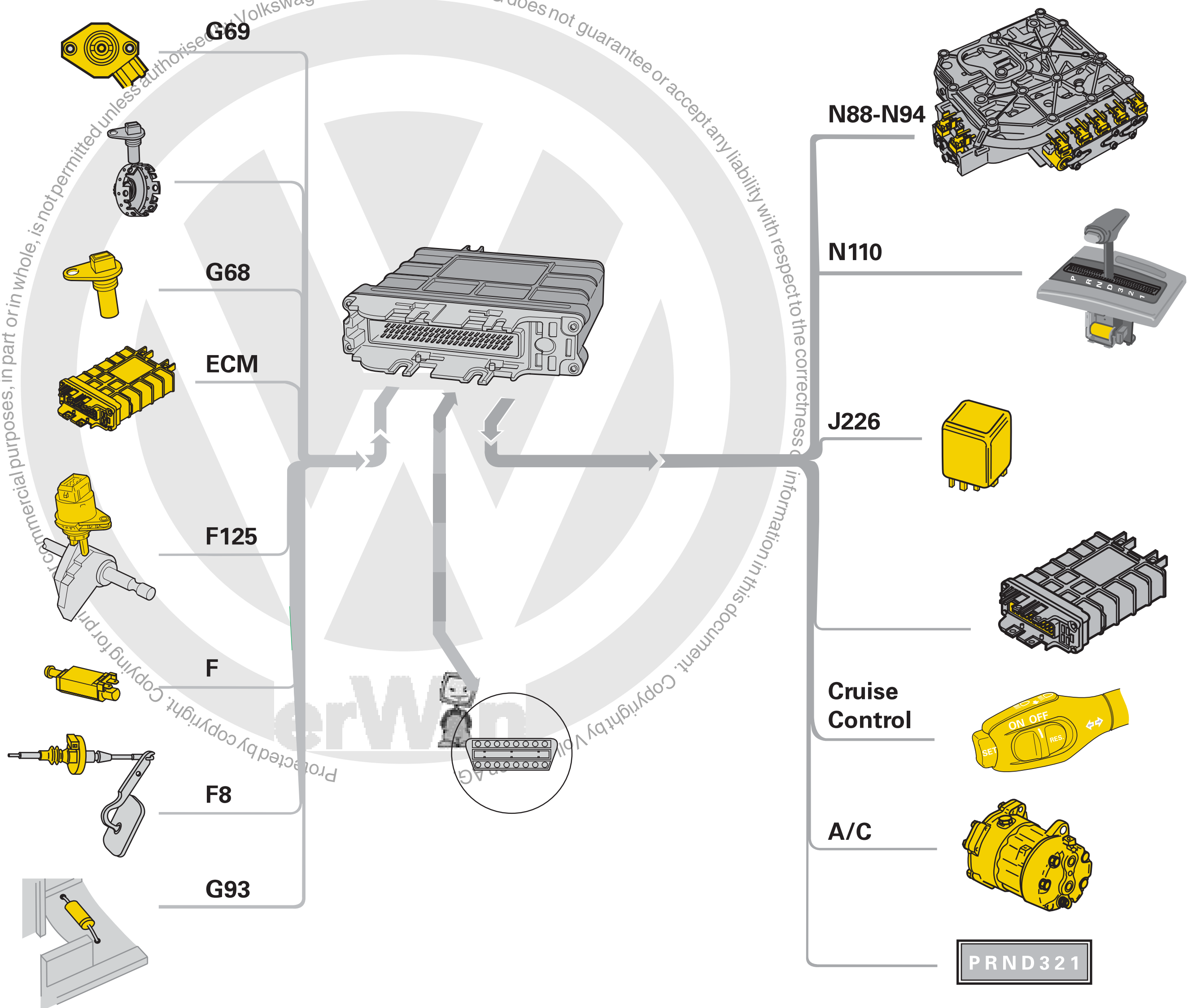
02 - Gearbox electronics
01P927733CM
AG4 Getriebe 01P 4973
Coding 0
Dealership number 0

Display group 0

Read data block
Data Block
Basic settings
Basic Settings
Test Instruments
Go to
Print
Help

Function 08, Reading Measured Value Blocks

The signals of the components shown in color can be tested in Function 08, Reading Measured Value Blocks.


G69
G68
ECM
F125
F
F8
G93
N88-N94
N110
J226
Cruise Control
ON OFF
SET
RES
A/C
PRND321

90010610.EPS

Notes

Knowledge Assessment

An on-line Knowledge Assessment (exam) is available for this Self-Study Program.

The Knowledge Assessment may or may not be required for Certification.

You can find this Knowledge Assessment at:

www.vwwebsource.com

From the vwwebsource.com Homepage, do the following:

- Click on the Certification tab
- Type the course number in the Search box
- Click "Go!" and wait until the screen refreshes
- Click "Start" to begin the Assessment

For Assistance, please call:

Certification Program Headquarters
1 - 877 - CU4 - CERT
(1 - 877 - 284 - 2378)
(8:00 a.m. to 8:00 p.m. EST)

Or, E-Mail:

Comments@ VWCertification.com

Four-Speed Automatic Transmissions

Volkswagen of America, Inc.
3800 Hamlin Road
Auburn Hills, MI 48326
Printed in U.S.A.
October, 2003

Cautions & Warnings

Please read these WARNINGS and CAUTIONS before proceeding with maintenance and repair work. You must answer that you have read and you understand these WARNINGS and CAUTIONS before you will be allowed to view this information.

- If you lack the skills, tools and equipment, or a suitable workshop for any procedure described in this manual, we suggest you leave such repairs to an authorized Volkswagen retailer or other qualified shop. We especially urge you to consult an authorized Volkswagen retailer before beginning repairs on any vehicle that may still be covered wholly or in part by any of the extensive warranties issued by Volkswagen.

- Disconnect the battery negative terminal (ground strap) whenever you work on the fuel system or the electrical system. Do not smoke or work near heaters or other fire hazards. Keep an approved fire extinguisher handy.

- Volkswagen is constantly improving its vehicles and sometimes these changes, both in parts and specifications, are made applicable to earlier models. Therefore, part numbers listed in this manual are for reference only. Always check with your authorized Volkswagen retailer parts department for the latest information.

- Any time the battery has been disconnected on an automatic transmission vehicle, it will be necessary to reestablish Transmission Control Module (TCM) basic settings using the VAG 1551 Scan Tool (ST).

- Never work under a lifted vehicle unless it is solidly supported on stands designed for the purpose. Do not support a vehicle on cinder blocks, hollow tiles or other props that may crumble under continuous load. Never work under a vehicle that is supported solely by a jack. Never work under the vehicle while the engine is running.

- For vehicles equipped with an anti-theft radio, be sure of the correct radio activation code before disconnecting the battery or removing the radio. If the wrong code is entered when the power is restored, the radio may lock up and become inoperable, even if the correct code is used in a later attempt.

- If you are going to work under a vehicle on the ground, make sure that the ground is level. Block the wheels to keep the vehicle from rolling. Disconnect the battery negative terminal (ground strap) to prevent others from starting the vehicle while you are under it.

- Do not attempt to work on your vehicle if you do not feel well. You increase the danger of injury to yourself and others if you are tired, upset or have taken medicine or any other substances that may impair you or keep you from being fully alert.

- Never run the engine unless the work area is well ventilated. Carbon monoxide (CO) kills.

- Always observe good workshop practices. Wear goggles when you operate machine tools or work with acid. Wear goggles, gloves and other protective clothing whenever the job requires working with harmful substances.

- Tie long hair behind your head. Do not wear a necktie, a scarf, loose clothing, or a necklace when you work near machine tools or running engines. If your hair, clothing, or jewelry were to get caught in the machinery, severe injury could result.

- Do not re-use any fasteners that are worn or deformed in normal use. Some fasteners are designed to be used only once and are unreliable and may fail if used a second time. This includes, but is not limited to, nuts, bolts, washers, circlips and cotter pins. Always follow the recommendations in this manual - replace these fasteners with new parts where indicated, and any other time it is deemed necessary by inspection.

next

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Version 1.0

Cautions & Warnings

- Illuminate the work area adequately but safely. Use a portable safety light for working inside or under the vehicle. Make sure the bulb is enclosed by a wire cage. The hot filament of an accidentally broken bulb can ignite spilled fuel or oil.

- Friction materials such as brake pads and clutch discs may contain asbestos fibers. Do not create dust by grinding, sanding, or by cleaning with compressed air. Avoid breathing asbestos fibers and asbestos dust. Breathing asbestos can cause serious diseases such as asbestosis or cancer, and may result in death.

- Finger rings should be removed so that they cannot cause electrical shorts, get caught in running machinery, or be crushed by heavy parts.

- Before starting a job, make certain that you have all the necessary tools and parts on hand. Read all the instructions thoroughly; do not attempt shortcuts. Use tools that are appropriate to the work and use only replacement parts meeting Volkswagen specifications. Makeshift tools, parts and procedures will not make good repairs.

- Catch draining fuel, oil or brake fluid in suitable containers. Do not use empty food or beverage containers that might mislead someone into drinking from them. Store flammable fluids away from fire hazards. Wipe up spills at once, but do not store the oily rags, which can ignite and burn spontaneously.

- Use pneumatic and electric tools only to loosen threaded parts and fasteners. Never use these tools to tighten fasteners, especially on light alloy parts. Always use a torque wrench to tighten fasteners to the tightening torque listed.

- Keep sparks, lighted matches, and open flame away from the top of the battery. If escaping hydrogen gas is ignited, it will ignite gas trapped in the cells and cause the battery to explode.

- Be mindful of the environment and ecology. Before you drain the crankcase, find out the proper way to dispose of the oil. Do not pour oil onto the ground, down a drain, or into a stream, pond, or lake. Consult local ordinances that govern the disposal of wastes.

- The air-conditioning (A/C) system is filled with a chemical refrigerant that is hazardous. The A/C system should be serviced only by trained automotive service technicians using approved refrigerant recovery/recycling equipment, trained in related safety precautions, and familiar with regulations governing the discharging and disposal of automotive chemical refrigerants.

- Before doing any electrical welding on vehicles equipped with anti-lock brakes (ABS), disconnect the battery negative terminal (ground strap) and the ABS control module connector.

- Do not expose any part of the A/C system to high temperatures such as open flame. Excessive heat will increase system pressure and may cause the system to burst.

- When boost-charging the battery, first remove the fuses for the Engine Control Module (ECM), the Transmission Control Module (TCM), the ABS control module, and the trip computer. In cases where one or more of these components is not separately fused, disconnect the control module connector(s).

- Some of the vehicles covered by this manual are equipped with a supplemental restraint system (SRS), that automatically deploys an airbag in the event of a frontal impact. The airbag is operated by an explosive device. Handled improperly or without adequate safeguards, it can be accidentally activated and cause serious personal injury. To guard against personal injury or airbag system failure, only trained Volkswagen Service technicians should test, disassemble or service the airbag system.

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Version 1.0

Cautions & Warnings

- Do not quick-charge the battery (for boost starting) for longer than one minute, and do not exceed 16.5 volts at the battery with the boosting cables attached. Wait at least one minute before boosting the battery a second time.

- Never use a test light to conduct electrical tests of the airbag system. The system must only be tested by trained Volkswagen Service technicians using the VAG 1551 Scan Tool (ST) or an approved equivalent. The airbag unit must never be electrically tested while it is not installed in the vehicle.

- Some aerosol tire inflators are highly flammable. Be extremely cautious when repairing a tire that may have been inflated using an aerosol tire inflator. Keep sparks, open flame or other sources of ignition away from the tire repair area. Inflate and deflate the tire at least four times before breaking the bead from the rim. Completely remove the tire from the rim before attempting any repair.

- When driving or riding in an airbag-equipped vehicle, never hold test equipment in your hands or lap while the vehicle is in motion. Objects between you and the airbag can increase the risk of injury in an accident.

I have read and I understand these Cautions and Warnings.

back **OK**

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